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SOLOMON ISLAND FERNS

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TWENTY-THREE PLATES

The Pteriodophytes collected in the Solomon Islands by Messrs. S. F. Kajewski and L. J. Brass, on several expeditions, supported by the Arnold Arboretum and directed by the Brisbane Botanic Gardens, were sent to me for identification in 1933. It was the plan of the arboretum to publish a comprehensive report on the collections of all kinds, and my report on this group was sent there; but the plan is so indefinitely postponed that I can now publish independently. The types of the new species, except *Dryopteris odontophora*, are in the Philippine National Herbarium.

The exploration of the Solomon Islands is necessary for an understanding of the colonization of Polynesia by ferns of ultimately Malay origin. The collections here described show how important is the place of the Solomons as a path of this colonization. We still know this flora too incompletely to justify any extended argument, but the connections with Papua and with Fiji which appear now for the first time are interesting and instructive. It appears already, also, that the Austral element is decidedly less in evidence here than in New Caledonia, or probably than even in the New Hebrides.

TMESIPTERIS OBLANCEOLATA Copel. sp. nov. Plate 1.

Caule 15–20 cm alta, parte tertia inferiore bracteata, sursum dense foliosa; foliis sterilibus 15–20 mm longis, 3 mm latis, oblanceolatis, apice rotundatis oblique et unilateraliter mucronatis,

costa alibi mediale; foliarum fertilium ramis minoribus, aliter conformibus; capsulis 3–4 mm longis, superficie sub lente reticulata.

GUADALCANAR, Tutuve Mountain, altitude 1,700 meters, *Kajewski 2632.* "A very small plant growing out of the moss on the stunted trees at high altitudes. Spore case brown, large."

I have noted elsewhere,[1] that with very many New Caledonia specimens in hand I could not find any correlation between the details of stem structure and other peculiarities. It must also be recognized as a fact that, while a few specimens may seem to represent species quite distinct in form and arrangement of leaves, these distinctions tend to be elided when many specimens are compared. Even so, a sufficient measure of distinctness in these respects should identify a species; and this seems to be provided by the broader distal halves of the leaves, the broadly rounded apices, and the almost symmetrical proximal halves of the leaves.

LYCOPODIUM FILICAULON Copel. sp. nov. Plate 2.

Phlegmaria; speciminibus ultra 1 m longis, fere simplicibus; ramis foliis inclusis ca. 25 mm latis, flaccidis, perlaxis; caule propia 0.6 mm crassa, internodiis vulgo 6 mm longis; foliis trifariis, plerisque ca. 20 mm longis, basin subsessilem versus 2–2.5 mm latis, deinde ad apicem acuminatam planam angustatis, rectis, integris, tenuibus; spicis vix 10 cm longis, 1.5 mm crassis, ad basin furcatis; sporophyllis e basi lata acuminatis, sporangia paullo superantibus sed haud tegentibus.

KONIGURU, Buin, Lake Luralu, altitude 1,500 meters, *Kajewski 2069.* "Common, in rain forest. A very long lycopod, hanging down from the trees sometimes, for a length of 2 meters. . . . Very graceful and slender, making this plant one of delicate beauty." BOUGAINVILLE, Kupei Gold Field, altitude 1,000 meters, *Kajewski 1702;* somewhat less long and lax, but easily the same species.

LYCOPODIUM LONGUM Copel. sp. nov. Plate 3.

Specimene basi carente ultra 1 m longo, pendente, repetiter dichotomo, ramis inter furcas 20 cm longis, basin versus foliis inclusis 3 cm latis, caule propria deorsum 1–1.5 mm crassa, foliis alternatim quadrifariis, confertis, maximis 17 mm longis, 2 mm latis, basi abrupte angustatis, integris, marginibus apices acuminatas versus subreflexis, herbaceis vel subrigidis, infra spicas abrupte diminutis; spicis ca. 15 cm longis, 5–7 mm crassis, ple-

[1] Univ. Calif. Publ. Bot. 14 (1929) 369.

risque 2 cm supra basin furcatis, sporophyllis 5 mm longis, supra basin sporangia protegentibus 1.7 mm latis, deinde angustatis, inflexis.

KUMUGARU, Buin, altitude 150 meters, *Kajewski 1953.* "Native name, *me-tarki.* A *Lycopodium* up to 2 meters long, hanging down from rain-forest trees." A relative of *L. pinifolium,* from which it differs most conspicuously by the inflexed sporophylls. The spikes are similar to those of the Philippine *L. Whitfordii,* from which and from *L. squarrosum* it is distinguished by the very slender axes and weaker leaves.

ANGIOPTERIS MICROURA Copel. sp. nov. Plate 4.

Stipite rhachique pilis brunneis 1 cm longis crinitis intricatis vestitis; pinnula fertile breviter (1.5 mm) stipitulata, ca. 12 cm longa, 12 mm lata, basi subsymmetrice truncato-cordata, marginibus parallelis crenulatis, apice abrupte in caudam 6–10 mm longam serratam contracta, papyraceis, inferne pallidis, costa fusca squamulis nonnulis fissis interdum piliferis ornata, lamina sparsisime squamulifera, venis tenuibus congestis, recurrentibus omnino carentibus; soris minutis, congestis, vix 1 mm a margine remotis, sporangiis 6–8.

SAN CHRISTOVAL, Waimamura, *Brass 2711.* This may be the fern responsible for the report of *A. caudata* De Vr. from the Bismarck Archipelago; but the Philippine type collection of that species has the pinnules gradually narrowed to coarsely serrate caudate tips 3 cm or more in length, the venation is lax, and recurrent veinlets are present; and still there is appreciable resemblance.

Brass's field note reads: "Usually found on the slopes of small ravines in the hills; very common. A typical large plant has a short, erect trunk 30 cm high by 46 cm diam. across the persistent auricles and bases of old fronds and young, large, widely spreading fronds. Typical frond 5.5 m long by 2.75 m broad. Pinnæ 24; lowermost 1.03 m long; longest (slightly below middle of lamina) 1.30 m; terminal one, 58 cm. Stipes 2.7 m long by 7 cm diam. at base, 3-angled. Stipe and rachis densely covered with short brown scales."

LEPTOPTERIS LAXA Copel. sp. nov. Plate 5.

Teste Kajewski, arbor trunco 175 cm alto et fronde 125 cm longa; rhachi sparse fibrillosa; pinnis medialibus 20 cm longis, 3.5–4 cm latis, acuminatis, sessilibus, rhachibus sat dense pubescentibus nisi apud basin anguste alatis; pinnulis anguste adnatis, usque ad 2 cm longis, 5 mm latis, obtusis, ad alam costae pinna-

tifidis, segmentis plerisque acutis, 1 mm latis, inferioribus remotis furcatis.

BOUGAINVILLE, Kupei Gold Field, altitude 1,200 meters, *Kajewski 1737*.

The collection consists of the upper part or apex of three fronds. The lower pinnæ of these fragments are more dissected than those of *L. Fraseri* or *L. Wilkesiana*, and distinct in appearance, because the lower segments of the lower pinnules are separated by more than their own width, connected by a wing of the costa no wider than the half-lamina of the segments. The denser pubescence of the lower part of the secondary rachises is in contrast with the sparse hairiness of the main rachis. In both of these respects, *L. laxa* is more distinct from the two related species than they are from one another.

In fact, I mistrust the specific distinctness of *L. Fraseri* and *L. Wilkesiana*. Fiji specimens representing the latter may have almost naked axes; while one New Caledonia collection in hand, *Le Rat 2819*, is as deeply dissected as is usual in Fiji specimens, and has the lower pinnæ strongly deflexed and moderately reduced.

GLEICHENIA KAJEWSKYI Copel. sp. nov. Plate 6.

Fronde monopodiale, ramis alternantibus statura definita iterum furcatis, lamina pectinata per internodia brevia usque ad 4 evoluta, axibus inferne squamulis appressis ovatis laceris obtectis; segmentis 10–14 mm longis, 2 mm latis, abrupte acutis, papyraceis, pilis minutis inflexis ciliatis, costis utroque latere squamulosis haud piliferis; soris costalibus, parvis, medio longitudine segmentarum fere contiguis, nec apices baseos appropinquantibus.

GUADALCANAR, Tutuve Mountain, altitude 1,200 meters, *Kajewski 2671*.

One of the group of *G. flagellaris*, already represented in this area by *G. oceanica* and *G. Brackenridgei*. Because of the fragmentary nature of specimens of other species, I do not know how distinctive this one may be in general plan of the frond; however that may be, the pubescence is diagnostic. At each forking of the main axis are borne a few, stipulelike, simple and pinnatifid leaflets 10 to 15 mm long.

CYATHEA VITTATA Copel. sp. nov. Plate 7.

C. contaminanti affinis; stipite basin versus paleis 2–25 mm longis, albido-fulvis anguste lanceolatis attenuatis vestito, sursum laete castaneo, furfuraceo glabrescente, irregulariter spinuloso; rhachi valida, castanea, densius spinosa; pinna mediale 70 cm

longa, pedicello 2 cm longo protensa, acuta, rhachi spinulosa. glabra vel glabrescente; pinnulis infimis pedicellatis paullulo reductis, plerisque 11.5 cm longis, 2 cm latis, sessilibus basi paullo dilatatis, brevi-acuminatis, basin versus pinnatis alibi profunde pinnatifidis, rhachi resp. costa inferne deorsum castaneo-furfuracea, medio longitudine saepe glabrescente, apicem versus more costularum squamulis et pilis ornata; segmentis usque ad 30-paribus, 3 mm latis, lineari-ellipticis, subfalcatis, integris, subcoriaceis, superne atroviridibus nudis, inferne ad costam piliferis, ad costam venasque squamulis pallidis bullatis obsitis; venulis 12- ad 14-paribus, distalibus simplicibus aliis furcatis; soris inframedialibus, contiguis, nudis.

YSABEL, Tiratoña, altitude 600 meters, *Brass 3313*. "Common. Tree fern, often more than 10 m tall; trunk usually unbranched; very basal part thickly covered with a dark mass of small aërial roots; remainder of trunk bare to within 0.5 m of top, with a number of shallow pits below each conspicuous leaf-scar; summit softly scaly. Fronds 10 to 12, spreading, 3 m or more long, including stipe about 60 to 70 cm long; pinnæ about 30, the lowest 4 or 5 set wide apart. Native name, *tonasagi*."

This may possibly be *C. bongardiana* (Mett.) Domin, never adequately described, merely [2] said to differ from *C. lunulata* in having "segments broader, entire, rather glaucous below, with copious scattered scales, veins more distant and obscure." The many minute scales are a striking character; but the venation of *C. vittata* is very close, and identity in other respects may not be assumed.

CYATHEA BAROTU Copel. sp. nov. Plate 8.

C. vittatae affinis, trunco breviore, fronde ampliore, paleis; stipitis angustioribus fere albis, et pilorum absentia distincta; stipitis base paleis albidis 1–25 mm longis, maximis 1 mm latis, vestita; pinna mediale 90 cm longa; pinnulis plerisque 16 cm longis, 3–3.5 cm latis, pinnulis [ii], resp. segmentis 3–3.5 mm latis, infimis inciso-crenatis, aliorum parte fertile crenata; sterile saepe dilatata subintegra, tenuiter papyraceis, inferne sat dense squamuliferis; venulis pinnatis, ramis plerumque 3, rarius 2 vel 4.

SAN CHRISTOVAL, Balego-nagonago, altitude 350 meters, *Brass 2822*. "Trunk about 3 m tall, covered with short, brown adventitious roots, and toward the summit densely matted pale brown scales; leaf-scars very conspicuous. Fronds about 5 m long in-

[2] Syn. Fil. 41.

cluding stipes, and 1.5 m broad near middle. Stipes 1 mm long, lower end brown, covered with pale, soft scales; lower surface of upper end of stipe and whole of rachis brown, upper surface glaucous-green. Natives eat the young, unopened fronds, either boiled or roasted. Local name, *barotu.*"

CYATHEA ACICULOSA Copel. sp. nov. Plate 9.

Stipite 40–50 cm longo sursum pinnis nonnulis abortivis onusto paleis tenuissimis 3 cm longis basi 1 mm latis ochraceis dense vestito, sursum inferne demum glabrescente etiam rhachibusque frondis et pinnarum asperis, fusco; pinnis inferioribus remotis decrescentibus stipitulatis, medialibus sessilibus, 50 cm longis, 11 cm latis sensim brevi-acuminatis, rhachibus atropurpureis fusco-furfuraceis; pinnulis numerosissimis, sessilibus, 5.5–6 cm longis, 14 mm longis, basi truncatis, apice abrupte acutis, fere ad apicem pinnatis, rhachillis paleis stramineis anguste ovatis 0.6 mm longis et minoribus obscuris vestitis; pinnulis [11] ca. 20-paribus, 7 mm longis, vix 2 mm latis, obtusis, plerisque basi truncatis superioribus adnatis, inferioribus basi inciso-crenatis, alibi crenatis vel apices versus integris, subcoriaceis, inferne pallescentibus, costis deorsum squamulis paucis vestitis; venulis ca. 7-paribus, inferioribus soriferis prope costam furcatis; soris costularibus sed faciem pinnulae complentibus, indusio fulvo, tenue, mox irregulariter fisso.

SAN CHRISTOVAL, Hinuahaoro, altitude 900 meters, *Brass 2887.*

"Native name, *baratu.* Tree fern, in mountain forest, only one plant seen, with thick trunk, and four rather erect fronds 2.7 m long, with spread of 1.2 m. Stipe and lower rachis covered with long brown scales, stipes only about 15 cm long; one or two very small barren pinnæ at base of rachis; pinnæ of next 40 to 50 cm of rachis all deciduous." There is no material discrepancy in measurements between the field note and the Latin description; Brass calls the region of abortive and deciduous pinnæ a part of the rachis, which it really is, but for descriptive purposes I prefer to call it part of the stipe, as it is in a physiological sense.

This species has some resemblance, and probably affinity, to *C. auriculifera,* of New Guinea, and to *C. celebica.*

CYATHEA ALTA Copel. sp. nov. Plate 10.

Eualsophila trunco altissimo, stipite speciminis 20 cm longo, 1–15 cm crasso, basi ad truncum decurrente paleis fusco-castaneis 1–15 cm longis lineari-acicularibus vestito, alibi furfuraceo,

spinuloso, superne (sicco) atrocastaneo, inferne rhachibusque brunneis; pinnis infimis remotis 15 cm longis, stipitulo 2 cm longo; pinnis medialibus sessilibus, 50 cm longis, 18 cm latis, in apicem lanceolatum acuminatam vix pinnatam abrupte contractis, rhachi furfuracea asperula; pinnulis sessilibus, 8–9.5 cm longis, basi 15 mm latis, argute serrato-acuminatis, fere ad costam pinnatifidis, costa inferne et paleis lanceolatis 0.5–1.5 mm longis castaneis pallido-marginatis et squamulis minutis vestito; segmentis 2 mm latis, obtusis vel subacutis, serratis, papyraceis, superne atroviridibus, inferne pallido-viridibus, costulis deorsum squamuliferis; venulis ca. 12-paribus, plerisque furcatis et soriferis; soris costularibus, ferrugineis, nudis, latetudinem segmenti fere complentibus.

YSABEL, Tiratoña, altitude 600 meters, *Brass 3330*. "Local name, *toñahatotogo*. Tree fern 15 m or more high; several slender stems erect from a root-covered common trunk; lower part or sometimes most of the stem free of frond-butts and densely root-covered; upper part rootless, and completely covered by appressed frond-butts. Fronds 10 to 12, wide-spreading, on average less than 3 m long; stipes 40 to 60 cm long, flattened, edges and upper surface of lower part green. Sori very dark brown." Discrepancies between the description of the fresh plant and the specimen are noted.

This has the aspect, as well as the technical characteristics, of the *Alsophila* group of Australia and Melanesia. It differs from most species in the narrower segments, from *A. MacArthurii* in the scales, from *A. samoensis* in being spiny.

CYATHEA SCABERULIPES (v. A. v. R.) Domin.

Cyathea scaberulipes (v. A. v. R.) DOMIN, Acta Bot. Bohemica 9 (1930) 174.

Alsophila scaberulipes v. A. v. R., Nova Guinea 14 (1924) 2.

SAN CHRISTOVAL, Star Harbor, *Brass 3124*.

Remarkable for its herbaceous texture and for the variety of scales and hairs on the axes, in both of which respects the specimen fits the description. The segments are serrate rather than crenate. And the paraphyses protrude beyond the young sori and provide a cobwebby covering for the young sorus.

The field note: "Common in hill rain-forests. Slender tree-fern, 2 to 3 m tall; trunk 5 to 7 cm in diam. at top, densely covered with pale, appressed scales. Fronds 10 to 12, not widely spreading, average length 1.8 m inclusive of stipe 50

to 60 cm long. Base of stipe appressed to trunk, thickly covered with long pale scales."

CYATHEA MELANOCLADA (v. A. v. R.) Domin.

Cyathea melanoclada DOMIN, Acta Bot. Bohemica 9 (1930) 174.
Alsophila melanocaulon v. A. v. R., Nova Guinea 14 (1924) 1.

Brass 2880, from Hinuahaoro, San Christoval, altitude 900 meters, may be identical with this New Guinea species. If so, one conspicuous feature, the restriction of the sori to the proximal part of the frond, escaped description. *Cyathea Hornei* shares this feature, but has the sterile "segments" closely placed, the pinnules pinnate only near the base. I would describe Brass's plant as freely tripinnate, with narrowly winged tertiary rachises; but van Alderwerelt may mean the same thing by "Pinnulae . . . dimidio inferiore pseudo-pinnatae . . . Segmenta remota. . . . inferiora . . . brevissime petiolulata, . . . basi truncata." Both *C. melanoclada* and *C. Hornei* are coriaceous, while the plant in hand is rather herbaceous. *Alsophila dissitifolia* Baker, described from Fiji, must also be very similar, if not identical with one of these.

Brass's field note reads: "Native name, *warotu.* Trunk 2 to 3 m high, 6 to 8 cm in diam., pink within when cut, covered with persistent leaf-bases. Fronds about 10, widely spreading, 2.1 m long. Stipe and rachis black, with shining brown scales. Lower very small pinnæ deciduous; only the lowermost 5 or 6 persistent pinnæ fertile." The scales are really, as described by van Alderwerelt, black, with lacerate brown margin. Dwarfed, mostly deciduous pinnæ extend down to the base of the stipe.

DRYOPTERIS ODONTOPHORA Copel. sp. nov.

Frondis lamina solummodo adest anguste ovata, (teste lectore usque ad 1 m) 50 cm longa, quadripinnata, glabra, papyracea, inferne paullo pallidiore, rhachibus stramineis, pinnis, pinnulis [1] et pinnulis [11] breviter stipitulatis, pinnulis [11] infimis 1 cm longis, oblongis, subincisis, segmentis ultimis sparsissime praecipue ad apices obtuse vel argute dentatis; venis paucis inconspicuis; soris plerisque venulas terminantibus, nudis.

GUADALCANAR, Vulolo, Tutuve Mountain, altitude 1,200 meters, *Kajewski 2687,* May 14, 1931.

Very near the Fijian *D. Gillespiei,* from which it is distinguished by the sparsely but conspicuously dentate segments. *Dryopteris maxima* (Baker) C. Chr., of Fiji, and *D. arborescens* (Baker) O. K., of Samoa, must be similar, but both are described

as indusiate; I find no trace of an indusium on young sori of *D. odontophora*. The stem is presumably stout and suberect.

DRYOPTERIS DOODIOIDES Copel. sp. nov. Plate 11.

Caudice erecto, inter baseos stipitum paleis ovatis parvis integris castaneis vestito; stipitibus fasciculatis, ca. 5 cm altis, deorsum obscuris glabrescentibus, sursum rhachibusque plumbeis dense pallide pubescentibus; fronde ca. 20 cm alta, 4 cm lata, pinnata, deorsum angustata pinnis subremotis, apice pinnatifida integrescente acuta; pinnis usque 30-paribus, medialibus 2–2.5 cm longis, 4–5 mm latis, obtusis vel subacutis, basi dilatatis, brevissime pedicellatis, decidue ciliatis, margine variabile aut subintegra aut irregulariter dentato-serrata, papyraceis, costa minute puberula; venis aut rectis aut fulmeniformi-dissipatis, inferne conspicuis, venulis plerumque 2-paribus infimis soriferis anastomosantibus; soris more Doodyae strictissime ordinatis, parvis sed fere contiguis, indusio reniformi-orbiculare, nudo.

SAN CHRISTOVAL, Huru River, altitude 50 meters, *Brass 3004*. "On rocks in the rain forest."

There is some resemblance to the Papuan *Dryopteris aquatilis*, but this may be due to a condensation of the frond in adaptation to a physiologically similar environment.

DRYOPTERIS OXYOURA Copel. sp. nov. Plate 12.

Caudice breve, erecto; stipite 50 cm alto vel altiore, ad basin imam paleis fuscis paucis et parvis vestita, sursum stramineo, decidue furfuraceo, pinnulis paucis remotis vestigialibus ornato; fronde ultrametrale altitudine, abrupte acuminata apice pinnatifida, rhachi minute furfuracea; pinnis superioribus basi oblique, acroscopice angustis, cuneatis, inferioribus 25 cm longis, lineari-lanceolatis, 3 cm latis, basin versus angustatis, apice in cadam integram acutissinam sensim angustatis, ultra mediam laminam pinnatifidis, herbaceis, costa inconspicue furfuracea, alibi glabris; segmentis 3–4 mm latis, subintegris, obtusis; venis ca. 10-paribus, plerumque 2-, rarius 3-paribus anastomos-antibus; soris ad venulas fere omnes medialibus, indusio parvo, minute setoso, sporangiis setosis.

SAN CHRISTOVAL, *Brass 2696*, absque commentariis.

In the general group of *D. truncata*, more deeply cut than most of its relatives, peculiar in the narrowed bases of the inframedial pinnæ; the shortened segments are more numerous than in the case of *D. Brackenridgei*, so that the effect is not that of a rounded base.

DRYOPTERIS MALODORA Copel. sp. nov. Plate 13.

D. feroci similis et affinis, setis fulvis, textura (sicca) papyracea, facie inferiore densius setosa, pinnis profundis (ad vel ultra mediam laminam) incisis lobis obtusis, venis 3-paribus anastomosantibus, indusiis nullis distincta; stipite rhachique valde setosis, costis pubescentibus; pinnis usque ad 40 cm longis, 2.5 latis, sessilibus, apice in caudam integram 3 cm longam sensim angustata.

SAN CHRISTOVAL, Huru River, *Brass 2688.*

The collector's field note reads: "Lowlands. Rare. Erect from an underground rootstock protruding just above the ground. Three to five fronds, 8 feet high with spread of 2 feet. Stipes about half the length of the entire frond, bright brown. Pinnæ mostly flatly spreading, but becoming more erect toward base of rachis, the basal pair standing at right angle with rachis. Juvenile unopened fronds a bright golden yellow. Bristles of stipe emit a pungent, objectionable odor when crushed."

DRYOPTERIS MYRIOSORA Copel. sp. nov. Plate 14.

D. Brackenridgei affinis et similis, pinnis ad alam costae vix 0.5 mm latam pectinatis, soris medialibus distincta; rhachi inferne apud insertionem pinnae quaeque aerophoro 1 mm alto praedita; pinnis medialibus 30 cm longis valde acuminatis, 3.5 cm latis, basi abrupte paullo angustatis, stipitulatis; costa straminea superne fusco-setulosa, inferne primo pubescente, dumum furfuracea; segmentis basi 3–4 mm latis, deinde angustatis, acutis, minute decidue ciliatis, acroscopicis fere rectangule distantibus falcatis, basiscopicis erecto-patentibus, incurvis, costulis inferne pallide setulosis; venulis ca. 30-paribus, fere omnibus soriferis; soris minutis, indusiis persistentibus aut nudis aut ad insertionem decidue setosis.

BOUGAINVILLE, Kupei Gold Field, altitude 1,000 meters, *Kajewski 1769.*

"A fern with fronds one and three quarters meters long, growing out of the ground. Five or six fronds form one plant." The lowest one or two segments are sometimes free.

Dryopteris Schlechteri Brause should be distinguished by less persistent indusia and obtuse segments, as well as by costular sori. This, *D. falcatopinnula* Copel., *D. alta* Brause, the species here described, and *D. Brackenridgei* form a well-marked group, ranging from Papua to Tahiti.

SPHAEROSTEPHANOS UNIJUGA Copel. sp. nov. Plate 15.

Rhizomate adscendente, breve, valido; stipitibus caespitosis, infra auriculas 6 cm longis, paleis atrocastaneis lanceolatis 6 mm longis puberulis et ciliatis vestitis, deinde usque ad pinnas normales 40 cm altis, pubescentibus, pinnis valde reductis plerisque hastatis deorsum decrescentibus et praecipue ibidem approximatis ornatis; fronde ultra 1 m alta, 30 cm lata, bipinnatifida, ubique setoso-pubescente, apice pinnatifida valde attenuata; pinnis haud remotis, sessilibus, 16 cm longis, 18 mm latis, in caudas integros 3 cm longas attenuatis, rhachi versus $\frac{2}{3}$ ad costas pinnatifidis, lobis oblongis subfalcatis, 3 mm latis, lobo infimo acroscopico elongato; venis ca. 11-paribus, infimis solummodo anastomosantibus; soris medialibus, indusiis oblongis, linea mediale perbreve adnatis, setosis, margine glandulis globosis ornatis.

San Christoval, Huru River, altitude 100 meters, *Brass 2692*, "Sunny slopes of the valley."

As to the indusium, fairly intermediate between two near relatives, *Sphaerostephanos polycarpa* and *Dryopteris sagittifolia*, distinct from both in the single pair of anastomosing veinlets, the second pair ending above the sinus. In Christensen's Index *Nephrodium microchlamys* Baker appears as a synonym of the former; its venation, as described, is like that of the plant in hand, but the description is otherwise very different—no reduced lower pinnæ, etc. Crowding of the lowest reduced pinnæ or auricles has been noted by Christensen on another relative, *D. polytis*, of Celebes.

Sphaerostephanos as a small genus blends with *Dryopteris* in its present usual sense. If, however, one be indisposed to recognize its distinctness as a small genus, it may still be maintained as a large one in any attempt to dismember *Dryopteris*.

DENNSTAEDTIA TRIPINNATIFIDA Copel. sp. nov. Plate 16.

Rhizomate repente, 6 mm crasso, pilis crassis brevibus vestito; stipite 1 m alto, ad basin nigram fere 1 cm crassam spinis plerisque deflexis 2 mm longis dense munito, sursum gracilescente spinulis sparsis in tubercula nigra decrescentia aspero, facie ventrale sulcata castanea, alibi atropurpureo, nitido; fronde 75 cm alta, rhachi inerme; pinnis suboppositis, remotis, horizontalibus, sessilibus, ad rhachim articulatis, majoribus 35 cm longis, 10 cm latis; pinnulis infirmis reductis, sequentibus 6 cm longis, basi subsessile 15 mm latis, deinde in caudam valde protractam

sensim angustatis, deorsum profunde oblique pinnatifidis, costa inferne pilulifera, lobis modo remotis, oblongis, ca. 4 mm latis, apice rotundatis, nudis, inferne pallidis, subcoriaceis; soro venulam infimam lobi insidente, minuto.

SAN CHRISTOVAL, Hinuahaoro, altitude 900 meters, *Brass 3043*, "1.2 to 1.5 m high. Fronds few, spreading. Upper surface of stipe and rachis bright-brown, lower almost black. Fronds very dark green." GUADALCANAR, Vulolo, Tutuve Mountain, altitude 1,200 meters, *Kajewski 2689*.

Cyathea erythrorachis, as identified for me by its author, Dr. Christ, is not quite tripinnate, but has conspicuously narrower and closer lobes, and lighter and less spiny stipes. The other species of the group, including *D. glabrata* and *D. Rosenstockii* from New Guinea, are all believed to be tripinnate.

TAPEINIDIUM TENUIUS Copel. sp. nov. Plate 17.

Rhizomate 2 mm crasso, pilis brevibus castaneis vestito; stipitibus 20–50 cm altis, avellanis, nudis; fronde deltoidea, 20–50 cm alta, 20–35 cm lata, quadripinnatifida; pinnis infimis aut deltoideis, aut (frondium maximarum) late lanceolatis, sequentibus oblique ovatis caudatis; pinnulis usque 6 cm longis, 1 cm latis, caudatis, basi angustatis; pinnulis inferioribus profunde oblique incisis lanceolatis, aliis potius late serratis ca. 1 cm longis 1.5 mm latis, decurrenti-adnatis; soris dentes fere omnes complentibus, parvis, indusio obconico.

SAN CHRISTOVAL, Hinuahaoro, altitude 900 meters, *Brass 3025*. YSABEL, Tiratoña, altitude 600 meters, *Brass 3335;* this is a single very large frond, the smaller figures in the dimensions given in the description applying to the type collection.

More finely dissected than any previously known representative of the genus. *Tapeinidium pinnatum* var. *tripinnata* Ros., of New Guinea, approaches it most nearly. Quadripinnatifid New Guinea plants called *T. Denhami* may be the species here described, but the latter is distinct from the Fiji plant properly called *T. tenue*, of which *T. Denhami* is a synonym.

HISTIOPTERIS HERBACEA Copel. sp. nov. Plate 18.

Rhachi laete fusca; auriculis 18 mm longis, 12 mm latis; pinna 40-50 cm longa, apice pinnatifida lobis perpaucis; pinnulis ca. 8-paribus, acutis, basi basiscopica cuneatis herbaceis, integris, supremis acroscopice adnatis, medialibus usque ad 16 cm longis, 2.5 cm latis, basi acroscopica rotundato-truncatis, infimis sessilibus utrinque sed oblique cuneatis, venulis ubique anastomo-

santibus reticulam finam efformantibus; soris apices pinnularum haud appropinquantibus, margine angustissima reflexa protectis.

YSABEL, Tiratoña, altitude 600 meters, *Brass 3337*. "Common in well-lighted places in the forests; wide-spreading, rambling fern. Stems brown with glaucous bloom. Fronds very pale glaucous-green."

Although something like the Bornean *H. stipulacea* in the large, entire pinnules, this species is very distinct in texture, and in various minor details—broader pinnules, absence of any basal prongs, etc. The largest pinnules are slightly sinuate in places.

OLEANDRA DIMORPHA Copel. sp. nov. Plate 19.

Rhizomate scandente, gracile, 2 mm crasso, paleis ciliatis basibus nigris fusco-marginatis peltatis apicibus rostratis setiformibus 2–3 mm longis vestitis; phyllopodiis 5 mm longis validis deorsum paleaceis sursum pilosis; stipite 1 cm alto (vel fr. fertilis 15 mm), piloso; fronde sterile 20 cm longa, 4 cm lata, apice abrupte angustata caudata, basi late cuneata vel rotundata, ciliata, papyracea, costa dense et venis sparsius pilis albis 1–2 mm longis obsitis; fronde fertile 40 cm longa, 6–10 mm lata, venatione laxa, soris inframedialibus, indusio reniforme oblique versus marginem aperto.

SAN CHRISTOVAL, Hinuahaoro, altitude 900 meters, *Brass 2916*. "Climbing on tree trunks."

Visible contraction of fertile fronds may sometimes be noted on plants of other species, but this is the first known to be very conspicuous in this respect.

SCYPHULARIA APPRESSA Copel. sp. nov. Plate 20.

Rhizomate latissime repente, 2–3 mm crasso, paleis ciliatis basi imo liberis subacutis deinde dilatatis et puncto nigro mediale affixis apice 2–3 mm longa aciculiformibus fusco-ferrugineis velustate modo nigrescentibus appressis itaque dense imbricatis vestitis; stipite 5–8 cm alta, gracile, nuda; frondibus pinnatis, sterile pentaphylla, pinnis 7 cm longis 1 cm latis, lanceolatis, subsessilibus, acuminatis, subintegris vel infra apicem serratis, fertilis pinnis 10 cm longis, 8 mm latis, acuminatis vel caudatis, basi cuneatis, dentatis; soris infra sinus positis, indusiis ca. 2 mm longis et 1 mm latis, apice truncatis marginem haud attingentibus.

SAN CHRISTOVAL, Hinuahaoro, altitude 900 meters, *Brass 2872*. "Creeping on tree trunks. Very flexible gray stems."

Most like *S. dorsalis* Copel.,[3] of New Guinea, from which it differs in the paler, appressed paleæ and truncate indusia. Both of the fertile fronds seen have the apical pinnæ paired; on one of them one basal pinna is forked.

One of these fronds is monstrous in a very suggestive manner. Of its six pinnæ, three are without fruit on the very narrow tails, which may be regarded as normal. One has two indusiate sori near the tip, normal except as the lack of space makes them nearly parallel to the costa. The fifth bears an elongate dorsal group of naked sporangia. The sixth bears a group of naked sporangia 3 mm long, occupying one margin, and spreading thence over the upper, not the nether, surface. If found sterile, van Alderwerelt's genus *Parasorus*, with the sporangia sunk in the margin, would pass without question as *Scyphularia*.

GRAMMITIS BRASSII Copel. sp. nov. Plate 21.

Caudice paleis lanceolatis fusco-ferrugineis 3 mm longis vestita; stipitibus dense fasciculatis, 5–8 mm longis, validis, pilis brevibus castaneis dense vestitis; fronde usque ad 10 cm longa et 5 mm lata, utrinque angustata, obtusa, firma et vetustate opaca, costa et faciebus ubique setulis minutis inconspicuis vestitis; venis sterilibus simplicibus, fertilibus apud costam furcatis, ramo acroscopico brevissimo soro occulto; soris costalibus parvis, contiguis, orbicularibus, sporangiis setuliferis.

SAN CHRISTOVAL, Hinuahaoro, altitude 900 meters, *Brass 2926*, in moss on tree trunks.

CAMPIUM KAJEWSKII Copel. sp. nov. Plate 22.

C. gregis C. quoyani C. rivulari affine; fronde sterile 30–40 cm alta, 15–20 cm lata, parte apicale magna pinnatifida lobis paucis oblongis; rhachi valida fusca, paleis brunneis lanceolatis 2 mm longis plus minus deciduis vestita; pinnis 5-paribus, 8–10 cm longis, 3.5 cm latis, supremis adnatis integris, medialibus sessilibus subsinuatis, infimis pedicellatis grosse crenatis, acutis, basi diverse rotundatis, nigrescentibus, coriaceis; venis primariis subconspicuis, vix ad marginem protensis, areolis irregulariter 5- vel 6- seriatis inter venas et 6–7 inter costam et marginem interpositis, venulis liberis nullis; fronde fertile aequilonga sed angustiore, pinnis ca. 15-paribus, majoribus 7 cm longis, 1 cm latis, profunde crenatis, basi truncatis.

BOUGAINVILLE, Kupei Gold Field, altitude 1,000 meters, *Kajewski 1763*. "A fern up to one and a half meters high, with sterile and fertile fronds on the same plant; common." From

[3] Univ. Calif. Publ. Bot. 12 (1931) 401.

this note it seems likely that the single sterile frond sent me, with only the upper end of the stipe, is undersized.

Although I am familiar with the instability of form of many *Campium* species, and have in mind the great difference between *C. rivulare* as first described and as more recently collected, *C. Kajewskii* seems to me to be well outside the known or reasonable range of variation either of it or *C. quoyanum*, of which latter *Chrysodium Naumanni* Kuhn is the form geographically nearest.

ANTROPHYUM MEGISTOPHYLLUM Copel. sp. nov. Plate 23.

Rhizomate breve, 3 mm crasso, paleis castaneis 1–2 mm longis haud dense vestito, more generis radicibus occulto; fronde unica visa 65 cm alta, ad apicem rotundo-truncatam cuspidatam 14.5 cm lata, deinde sensim usque ad stipitem vix 5 mm longum angustata, subcoriacea, costa prope mediam laminam aborta; areolis ubique elongatis, venis longitudinalibus omnibus nisi apud marginem soriferis, soris usque ad 20 cm longis rarius inter se connexis; capitibus paraphysium parvis, globosis, rugosis, atrocastaneis.

SAN CHRISTOVAL, Huru River, altitude 50 meters, *Brass 3003*. "On a tree trunk in rain forest, very rare. Four stiff fronds from a tuft of brown roots."

Besides the new species, the collection demonstrates a number of extensions of range, some westward, some eastward. These, and some miscellaneous notes, follow:

OPHIOGLOSSUM PENDULUM Linn.

SAN CHRISTOVAL, Hinuahaoro, altitude 500 meters, *Brass 2902*. "Common, on forest floor." Several fronds suggest the Bornean *O. Moultoni*, but one is within the range of short specimens of *O. pendulum*. I am the less tempted to describe it, because of a suspicion that *O. pendulum* might assume this form if accidentally or otherwise terrestrial.

TRICHOMANES TAENIATUM Copel.

YSABEL, *Brass 3305*. Previously known from the Society Islands.

TRICHOMANES BIPUNCTATUM Poir.

YSABEL, *Brass 3390*.

TRICHOMANES BECCARIANUM Cesati.

SAN CHRISTOVAL, *Brass 2730*. This carries the range eastward, close to that of the similar *T. cultratum*.

CEPHALOMANES OLONGIFOLIUM Presl.

SAN CHRISTOVAL, *Brass 2899*. A common Philippine species, doubtfully reported from Amboyna.

DRYOPTERIS BRACKENRIDGEI (Mett.) O. K.

SAN CHRISTOVAL, *Brass 2799*. Already known from Fiji, Samoa, and Tahiti.

DRYOPTERIS HARVEYI (Mett.) O. K.

SAN CHRISTOVAL, *Brass 2575*. Less dissected and wider pinnæ than the typical plant; hitherto unreported west of Fiji.

DRYOPTERIS MAGNIFICA Copel.

SAN CHRISTOVAL, *Brass 2576*. Already known in Fiji only.

DRYOPTERIS GLANDULOSA (Blume) O. K.

GUADALCANAR, *Kajewski 2679*. Known only from Malaya. The indusia and the golden glands can be detected only on the youngest fronds.

CYCLOPELTIS NOVOGUINEENSIS Ros.

YSABEL, *Brass 3187*. "Common also in San Christoval, but not fertile there at time of my visit." Known from New Guinea only.

TECTARIA ANGULATA (Wild.) C. Chr.

Polypodium angulatum Willd., Sp. Plant. 5 (1810) 105.

SAN CHRISTOVAL, *Brass 2606*. This specimen is exindusiate, as are New Guinea plants so named; otherwise it is like plants with fugacious indusia from farther west.

ATHYRIUM ACCEDENS (Blume) Copel.

BOUGAINVILLE, *Kajewski 1760*. SAN CHRISTOVAL, *Brass 2788*. The latter a very simple form, with secondary areolation.

ASPLENIUM POWELLII Baker (?).

BOUGAINVILLE, *Kajewski 2166*. This fits the description of the Samoan plant (which I have not seen), except that the ultimate segments are longer. As compared with *A. shuttleworthianum* Kze. (at least with *A. multifidum* Brack.), the Bougainville plant is very distinct in appearance, because it has deltoid pinnules of all orders.

ASPLENIUM FEEJEENSE Brack.

BOUGAINVILLE, *Kajewski 1762*. Previously reported from Fiji and Samoa.

ASPLENIUM SCOLOPENDROPSIS F. v. M.

BOUGAINVILLE, *Kajewski 1776*. Somewhat larger than as described, and not absolutely glabrous; known before from Papua.

Phyllitis schizocarpa (Copel.) v. A. v. R., described from Mindanao and reported from Papua, seems to differ from *A. scolopendropsis* in texture, in being opaque, in being slightly more scaly, and in having a short, distinct stipe, but the differences may be apparent only. If removed from *Asplenium*, this fern should be called *Diplora*.[4] The Solomons are the type locality of *D. integrifolia* Baker.

LINDSAYA SESSILIS Copel.

BOUGAINVILLE, *Kajewski 1961*. GUADALCANAR, *Kajewski 2662*. SAN CHRISTOVAL, *Brass 2783*. Originally described as having fronds not over 20 cm long, but a later collection by King had fronds of twice this length. This must be almost doubled again to fit the Solomon Island specimens; but, except in stature and in obviously correlated features, these differ nowise from the Papuan plant. It is distinguished from *L. pectinata* by small sori and vestigial indusia.

CRASPEDODICTYUM GRANDE Copel.

BOUGAINVILLE, *Kajewski 1869*. SAN CHRISTOVAL, *Brass 2865*, with very large fertile simple fronds as well as ternate ones. Described from Papua; now found common in the Solomons.

CRASPEDODICTYUM QUINATUM (Hooker) Copel.

YSABEL, *Brass 3334*, identification not positive. Even after the removal of the West Malayan *C. coriaceum*,[5] on the ground that Hooker surely described at once and under one name two distinct species, it is still difficult to recognize his *Gymnogramme quinata*. He cited three collections, and may have had three species. The first citation is from Vanecolla.

PTERIS BECCARIANA C. Chr.

SAN CHRISTOVAL, *Brass 2689*. Previously known from New Guinea.

HEMIPTERIS WERNERI Ros.

GUADALCANAR, Tutuve Mountain, altitude 1,200 meters, *Kajewski 2681*, common. YSABEL, Tiratoña, altitude 600 meters, *Brass 3328*. Previously known by but two collections in New Guinea.[6] The Ysabel plant has wider segments and a wider costal wing than the type; the Guadalcanar plant has the segments

[4] See Univ. Calif. Publ. Bot. 16 (1929) 73.
[5] Philip. Journ. Sci. 38 (1929) 146.
[6] See Univ. Calif. Publ. Bot. 12 (1931) 396, pl. 51.

separate almost to the costa. Brass's field note reads: "Common name *diamoro*. Three or four very large fronds, erect from a rather small stock supported above ground on stiff roots. Stipes about 1.5 m long and up to 3 cm thick at base; lower part brown, with a green stripe on each side, continued higher as a narrow dark line to base of lamina. Juice from crushed young fronds taken by native women to assist childbirth."

ADIANTUM ROBINSONII v. A. v. R.

SAN CHRISTOVAL, *Brass 2901*. Identical with the type (and only previous) collection, from Amboyna, except in being larger, and accordingly in being tripinnate at base.

ADIANTUM HORNEI Baker.

GUADALCANAR, *Kajewski 2670*. Known from Fiji only.

DRYMOGLOSSUM FALLAX v. A. v. R.

YSABEL, *Brass 3360*. Already known from Amboyna, Buru, Papua, and New Britain.

MICROSORIUM LINGUAEFORMIS (Mett.) Copel.

BUIN, *Kajewski 1972*. SAN CHRISTOVAL, *Brass 2639*. Kajewski's collection includes one stipitate frond with narrowly cuneate decurrent base; and one frond with blade 14 cm wide. The rhizome is slender—on Kajewski's plants only 1 to 2 mm thick; on Brass's, somewhat stouter. It probably serves essentially as an organ of propagation, each frond, with the short stem segment bearing a mass of felted roots within its base, being a practically independent unit.

MICROSORIUM POLYPODIUM SUBGEMINATUM Christ.

GUADALCANAR, *Kajewski 2571*. Known from Papua only. The phyllophore branches are up to 2 cm long, and bear or have borne as many as ten fronds each. The lowest sori are likely to be elongate, which happens in Papua also.

AGLAOMORPHA HERACLEA (Kunze) Copel.

BOUGAINVILLE, *Kajewski 1767*. Previous known range, Malaya and New Guinea.

MERINTHOSORUS DRYNARIOIDES (Hooker) Copel.

BOUGAINVILLE, *Kajewski 1949, 2039*. YSABEL, *Brass 3184*. This was described as glabrous, with citation of specimens from Malay Peninsula and Solomon Islands. The local specimens are glabrous, but those I have seen from western Malaya are pubescent on the upper side of the costæ, etc.

ILLUSTRATIONS

[Drawings for plates 2, 3, 7, 8, 9 and 10 were made by Alicbusan; for all others by Borbe. Photographs by the Department of Agriculture and Commerce.]

PLATE 1. *Tmesipteris oblanceolata* sp. nov., type, × 0.5; sterile and fertile leaves, × 2.5.

2. *Lycopodium filicaulon* sp. nov., type, × 0.4; part of spike, × 8.
3. *Lycopodium longum* sp. nov., type, × 0.4; part of spike, × 8.
4. *Angiopteris microura* sp. nov., type, × ⅛; detail of pinna, × 3.75.
5. *Leptopteris laxa* sp. nov., type, × ⅛; pinnule, × 3.7.
6. *Gleichenia Kajewskii* sp. nov., type, × 0.4; detail of segment, × 8.
7. *Cyathea vittata* sp. nov., type, × 0.34; segment, × 3.4; paleæ of axis and veinlet, × 47.
8. *Cyathea Barotu* sp. nov., part of type, × 0.5; distal part of segment, × 5; scales on veinlets, × 115.
9. *Cyathea aciculosa* sp. nov., type, × ⅛; segment, × 3.7.
10. *Cyathea alta* sp. nov., type, × ⅛; paleæ, × 37.
11. *Dryopteris doodioides* sp. nov., type, × 0.4; pinna, × 2.
12. *Dryopteris oxyoura* sp. nov., type, × 0.4; segment, × 2.
13. *Dryopteris malodora* sp. nov., type, × 0.4; hairs on stipe, × 0.8; segment, × 2.
14. *Dryopteris myriosora* sp. nov., type, × 0.4; young fertile segment, × 4; large fertile segment, × 1.2.
15. *Sphaerostephanos unijuga* sp. nov., type, × 0.36; segment, × 1.8; sorus, × 10.8; folded indusium, × 7.2.
16. *Dennstaedtia tripinnatifida* sp. nov., type, × ⅛; detail of pinnule, × 1.85.
17. *Tapeinidium tenuius* sp. nov., type, 0.35; segment, × 3.5.
18. *Histiopteris herbacea* sp. nov., type, × ⅛.
19. *Oleandra dimorpha* sp. nov., type, × 0.36; detail of fertile frond, × 3.6.
20. *Scyphularia appressa* sp. nov., type, × ⅛; detail of fertile frond, × 3.7.
21. *Grammitis Brassii* sp. nov., type, × 0.5; detail of frond, × 5; palea, × 25.
22. *Campium Kajewskii* sp. nov., type, × ⅛; venation, slightly enlarged.
23. *Antrophyum megistophyllum* sp. nov., type, × 0.4.

PLATE 1.

PLATE 2.

PLATE 3.

PLATE 4.

PLATE 5.

PLATE 6.

PLATE 7.

PLATE 8.

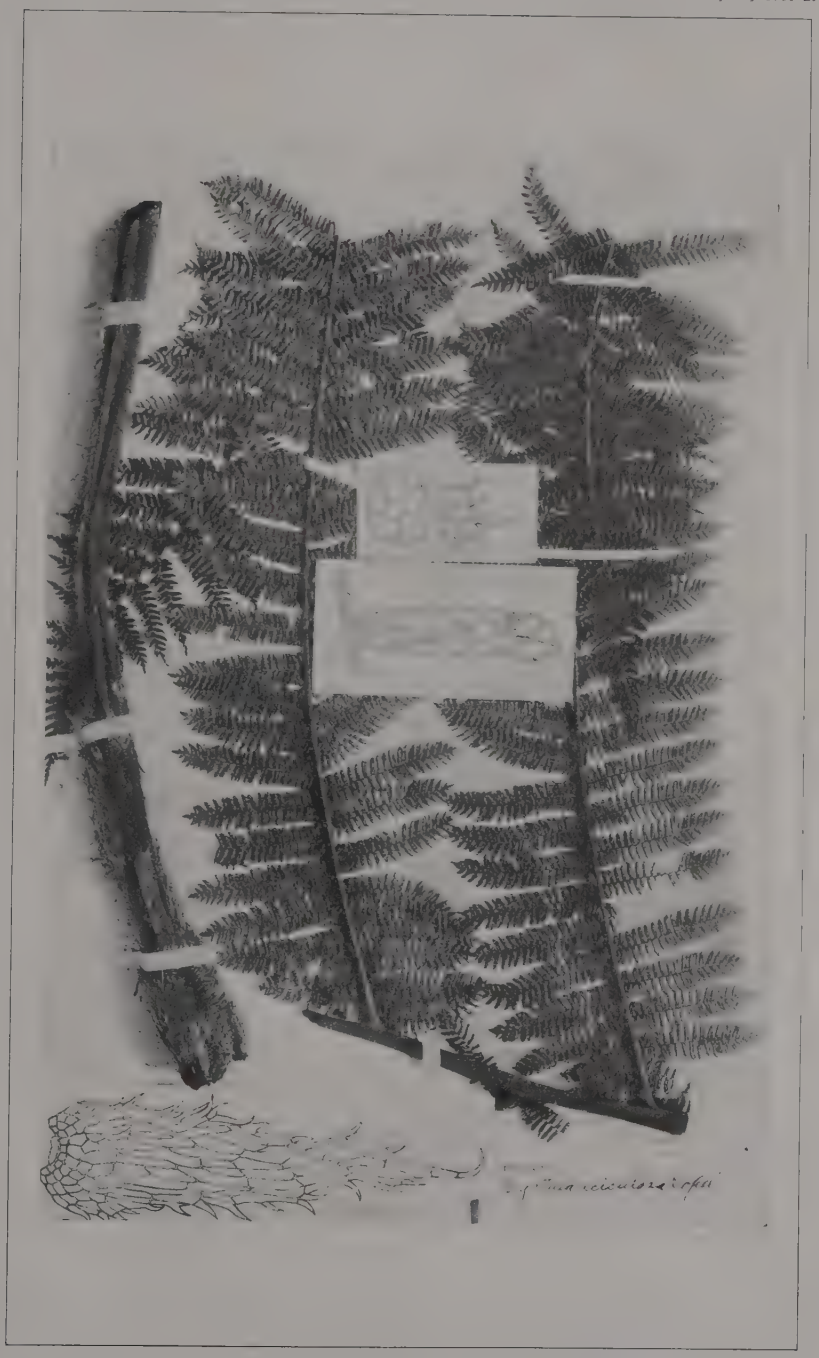


PLATE 9.

PLATE 10.

PLATE 11.

PLATE 12.

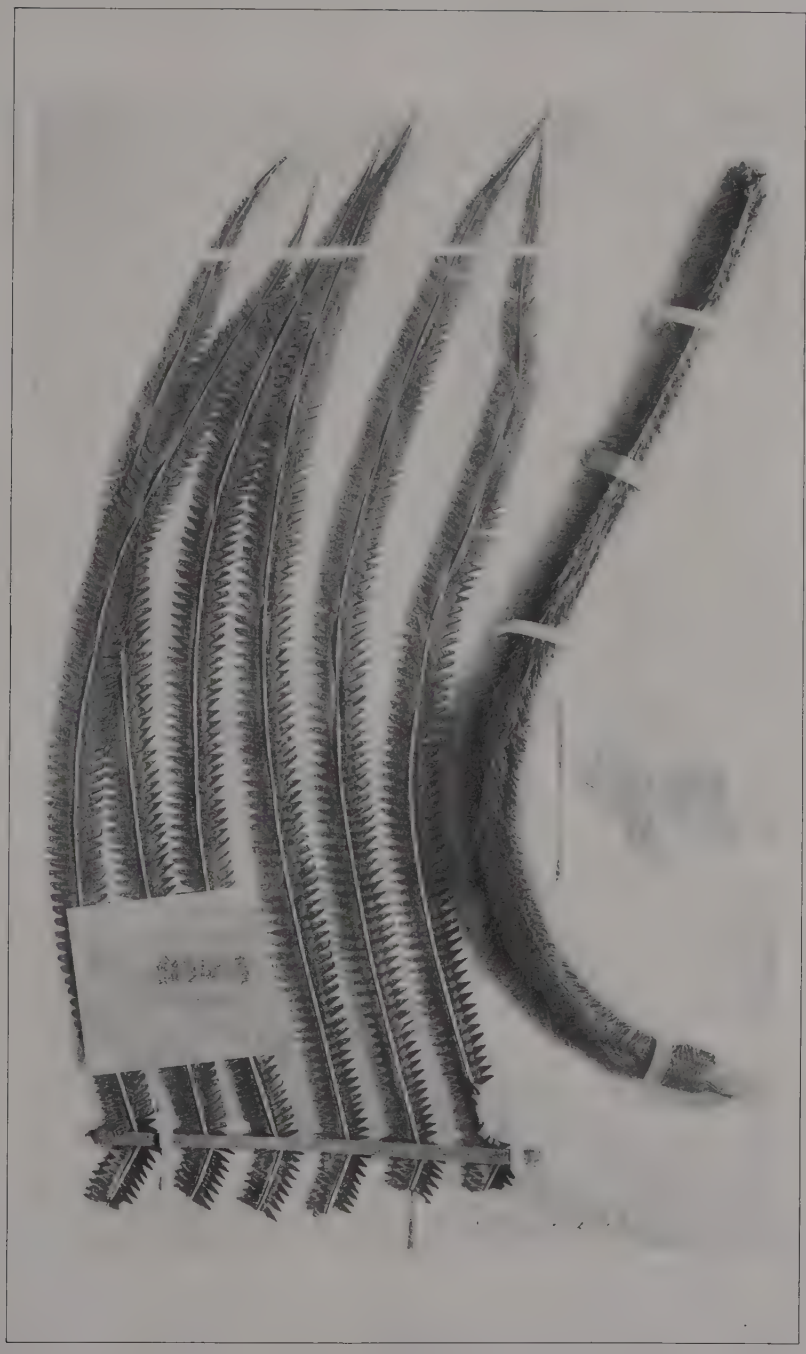


PLATE 13.

PLATE 14.

PLATE 15.

PLATE 16.

PLATE 17.

PLATE 18.

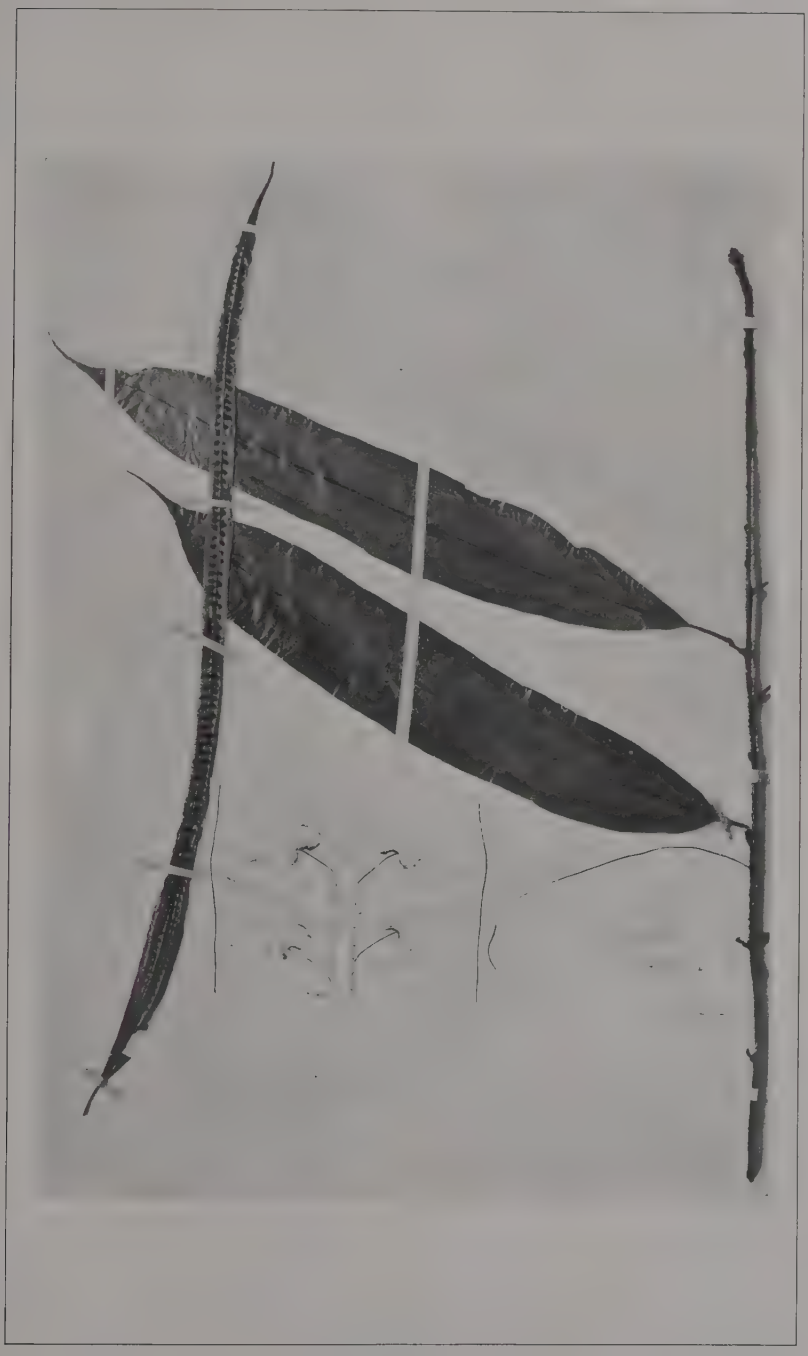


PLATE 19.

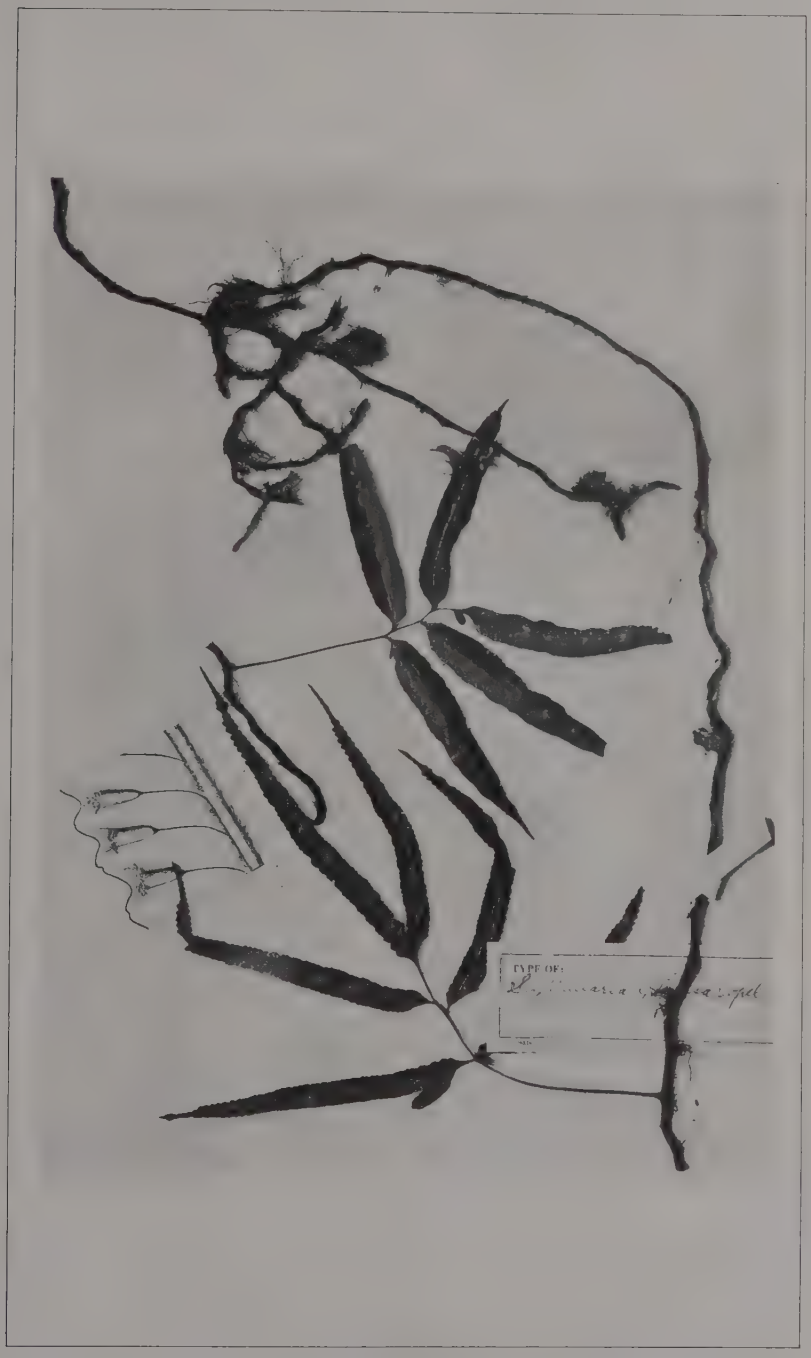


PLATE 20.

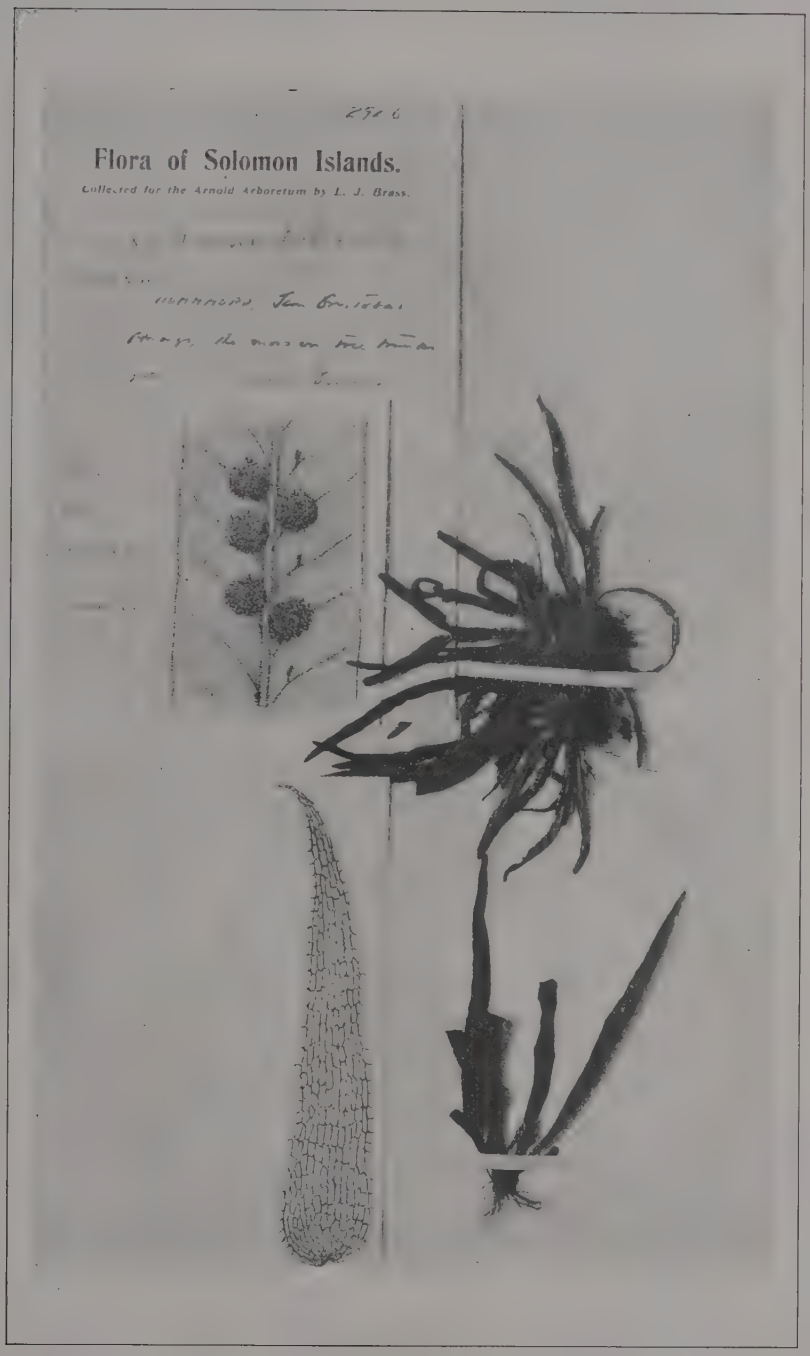

Flora of Solomon Islands.
Collected for the Arnold Arboretum by L. J. Brass.

PLATE 21.

PLATE 22.

PLATE 23.

NEW OR NOTEWORTHY LOWER FUNGI OF THE PHILIPPINE ISLANDS, I[1]

By E. F. Roldan[2]

Of the Department of Plant Pathology, College of Agriculture, Los Baños

TWO PLATES

The present paper records seven species of lower fungi, five of which are new and two hitherto unrecorded as occurring in the Philippine Islands. These seven species of fungi herein described are from materials either collected by the writer or communicated to the Department of Plant Pathology of the College of Agriculture at Los Baños, Laguna, for determination.

The type specimens of the five new species are deposited in the Baker Herbarium of the Department of Plant Pathology of the College of Agriculture, Los Baños, Laguna, Philippine Islands.

CYLINDROCLADIUM SCOPARIUM Morg.

Cylindrocladium scoparium Morg. in Bot. Gaz. 17 (1892) 190–192.

On the petioles of *Oenothera lamarckiana* introduced into the Philippine Islands. The fungus produces blotches which are chocolate-brown, chiefly caulicolous, 5 to 10 mm in length (Plate 1, fig. 1). The hyphæ are innate or superficial, floccose. The conidiophores are borne on fertile hyphæ, dichotomously or trichotomously branched, sterigmata subternate. The conidia are hyaline, 0- or 1-septate, smooth, cylindrical, 39 to 50 by 3.5 to 5.3 μ (Plate 2, figs. 1).

Luzon, Laguna Province, College of Agriculture campus, *E. F. Roldan 1*, April 1, 1931.

The fungus *Cylindrocladium scoparium* was described by Morgan as causing the canker of rose. This species has not hereto-

[1] Contribution No. 1124 from the Experiment Station of the College of Agriculture, Los Baños, Laguna. Read in the Third Philippine Science Convention, Manila, February 27, 1935. Published with the approval of the Dean of the College of Agriculture.

[2] The writer here records his thanks to Dr. G. O. Ocfemia, of the Department of Plant Pathology, College of Agriculture, for suggestions with regard to the preparation of this manuscript, and to Dr. Eduardo Quisumbing, of the Bureau of Science, Manila, for comments and criticisms.

fore been reported on *Oenothera* in the Philippine Islands or elsewhere.

CERCOSPORA CHRYSANTHEMI Heald and Wolf.

Cercospora chrysanthemi HEALD and WOLF in Mycologia 3 (1911) 15.

This fungus resembles very closely *Cercospora chrysanthemi* Heald and Wolf on *Chrysanthemum* sp. and is here considered identical with it.

On the host the spots are follicolar, 0.5 to 12 mm in diameter, amphigenous, irregularly circular, confluent, brownish (Plate 1, fig. 4). Conidiophore brown, simple, amphigenous, but more abundant below, fascicled, straight or subflexuous, 1- to 4-septate, 37.5 to 193.5 by 5.5 to 8 μ. Conidia hyaline, pleuroacrogenous, acicular to acicular obclavate, pleuroseptate, 6- to several-septate, 49.5 to 450 by 5 to 7 μ (Plate 2, fig. 2).

LUZON, Laguna Province, Los Baños, College of Agriculture campus, *E. F. Roldan 4,* September 10, 1933, on leaves of *Chrysanthemum coronarium* Linn.

COLLETOTRICHUM PITHECOLOBII sp. nov.

Maculis folicalis depressis, suborbicularibus, 2–6 mm diam., amphigenis pallido-flavis, sparsis v. confluentibus. Acervulis maculicolis, nigris, subamphigenis, applanatis, sparsis v. laxa gregariis, erumpentibus, parvis 60–85 μ diam.; setulis numerosis atro-fuscis, erectis, septatis nullis, apices acutis, 64–125 x 4–10.5 μ; conidiis falcatis, 14–28 x 3–7 μ intus granulosis, guttitalis.

Spots follicolar, 2 to 6 mm in diameter, depressed amphigenous, irregularly circular, pale yellow, scattered or confluent (Plate 1, fig. 3). Acervuli maculicolous amphigenous, though more abundant below, black, moderately abundant, scattered, erumpent, applanate, small, 60 to 85 μ in diameter. Setæ numerous, dark black, nonseptate, apices acute, 64 to 125 by 4 to 10.5 μ; conidia granular, falcate, hyaline, guttulate, 14 to 28 by 3 to 7 μ (Plate 2, fig. 3).

LUZON, Laguna Province, College of Agriculture campus, *E. F. Roldan 3,* September 16, 1932, on living leaves of *Pithecolobium dulce* (Roxb.) Benth.

PHOMA ROSAENA sp. nov.

Maculis cauligenis, 2–5 mm diam. suborbicularibus, sparsis v. confluentibus. Pycnidis maculis sparsis v. laxa gregariis subglobosis, papilliformi-erumpentibus, membranaceis, brunneis, 75–240 μ diam.; estiolo 10–28 μ circ. lato; sporulis elliptico-cylindraceis, hyalinis, continuis 3.5–6 x 1.5–2.5 μ.

Spots caulicolous, 2 to 5 mm in diameter, irregularly circular, scattered or sometimes confluent (Plate 1, fig. 2). Pycnidia scattered or loosely gregarious, erumpent, subglobular, membranous, brownish, 75 to 240 μ in diameter, slightly papillate; ostiolate, 10 to 28 μ across the ostiole. Spores hyaline, elliptic to subcylindric, 3 to 5 by 1.5 to 2.5 μ (Plate 2, fig. 4).

LUZON, Laguna Province, College of Agriculture campus, *E. F. Roldan 5*, January 26, 1931, on living stems of roses.

Other species of *Phoma* reported as upon the stems of roses are *P. rosae* Schultz and Sacc., *P. rosarum* Dur. and Mont., and *P. pusilla* Schultz et Sacc. but all of them are different from *Phoma rosaena.*

HELMINTHOSPORIUM LYCOPERSICI sp. nov.

Maculis, minutis, puntiformis, 0.25–3 mm diam., brunniis, sparsis v. coalescentibus, amphigenis; conidiophoris hypophyllis, fasciculatis, sparsis simplicibus, sub-flexeusis, olivo-brunneis, spetatis, non-constrictis 70–145 x 7–9 μ; conidiis acrogenis, clavatis, rectis v. leviter curvatis, 4- ad 12-septatis, non-constrictis, olivo-brunneis, 50–107 x 10–18 μ.

Spots small, punctiform, amphigenous, 0.25 to 3 mm in diameter, brownish, scattered or sometimes confluent (Plate 1, fig. 4). Conidiophores hypophyllous, scattered, simple, fascicled, subflexuous, olive-brown, septate, nonconstricted, 70 to 145 by 7 to 9 μ. Conidia acrogenous, clavate, straight or slightly curved, 4- to 12-septate, nonconstricted, olive-brown, 50 to 107 by 10 to 18 μ (Plate 2, fig. 5).

LUZON, Laguna Province, College of Agriculture campus, *E. F. Roldan 2*, February 13, 1931, on living leaves of *Lycopersicum esculentum* Linn.

PHYLLOSTICTA CARTHAMI sp. nov.

Maculis primo marginalis dein amplis, confluentibus et irregularibus, subunde fere totum folium occupantibus. Pycnidiis hypophyllis, numerosis, dispersis v. gregariis in maculis, membranaceis apud mesophyll, dispositis, primo tectis deinde expositis, subglobosis, 63–133 μ diam., papillatis, ostiolatis; ostiolo 14–21 μ lato; sporolis minutis, ovideis v. ellipsoideis, 7–10 x 2–2.6 μ hyalinis.

Spots folicolous, brownish at first marginal, irregular, confluent and then extensive, sometimes involving the entire leaf. Pycnidia 63 to 133 μ broad, hypophyllous, abundant, scattered or in groups, maculicole membranous, brownish, at first located in the mesophyll then exposed subglobular, papillate, ostiolate, 14

to 21 μ across the ostiole. Conidia minute, 7 to 10 by 2 to 2.6 μ, ovate or elliptical, hyaline (Plate 2, fig. 6).

LUZON, Laguna Province, College of Agriculture campus, *E. F. Roldan 6*, January 24, 1934, on leaves of *Carthamus tinctorius* Linn.

PESTALOZZIA HOMALOMENAE sp. nov.

Maculis suborbicularibus, angularibus, brunneis, sparsis v. confluentibus 1–2 x 2–5 mm diam.; acervulis amphigenis, punctiformibus, sparsis, subepidermidem, atris, erumpentibus in maculis 60–150 μ in diam.; conidiis elipticofusoides 14–21 μ longis 4-septatis ad septa leniter constrictis, loculis 3 interioribus, olivo-brunneis 10–14 x 5–9 μ, loculis extremis hyalines, setulis 2–3 rare 1, filiformibus brevi 6–14 μ longis, stipite brevi 5 μ longis hyalines.

Spots irregularly circular, angular, scattered or confluent, brownish, 1 to 2 by 2 to 5 mm diam.; acervuli maculicole amphigenous, punctiform, scattered, subepidermal, erumpent, black, 60 to 150 μ in diameter (Plate 1, fig. 6); spores elliptic-fusoid, 14 to 21 μ long, 4 septates with slight constriction at the point of septa, 3 middle cells olive-brown, 10 to 14 by 5 to 9 μ, exterior cells hyaline, 2 to 3 appendages, rarely 1, filiform, short, 6 to 14 μ long, stipitate, stalk short, 5 μ long, hyaline (Plate 2, fig. 7).

LUZON, Laguna Province, College of Agriculture campus, *E. F. Roldan 7*, September 10, 1934, on *Homalomena philippinensis* Engl.

ILLUSTRATIONS

Plate 1. Host Plants

Fig. 1. General appearance of the blotches at the base of the petioles of *Oenothera lamarckiana.*

2. General appearance of spots on the stems of a rose, produced by *Phoma roseana* sp. nov.

3. General appearance of the spots on the leaves of *Pithecolobium dulce,* produced by *Colletotrichum pithecolobii* sp. nov.

4. General appearance of the spots on the leaves of *Chrysanthemum coronarium,* produced by *Cercospora chrysanthemi* Heald and Wolf.

5. General appearance of the spots on the leaves of *Lycopersicum esculentum,* produced by *Helminthosporium lycopersici* sp. nov.

6. General appearance of the spots on the leaves of *Homalomena philippinensis* produced by *Pestalozzia homalomenae* sp. nov.

Plate 2. Species of Fungi

Fig. 1. *Cylindrocladium scoparium* Morg., conidiophores and conidia, × 670.

2. *Cercospora chrysanthemi* Heald and Wolf, conidiophores and conidia, × 670.

3. *Colletotrichum pithecolobii* sp. nov., acervulus, showing conidiophores, conidia, and setæ, × 670.

4. *Phoma roseanae* sp. nov., pycnidium, showing conidiophores and conidia, × 670.

5. *Helminthosporium lycopersici* sp. nov., conidiophores and conidia, × 670.

6. *Phyllosticta carthami* sp. nov., pycnidium, with conidia coming out from the ostiole, × 670.

7. *Pestalozzia homalomenae* sp. nov., conidia, × 670.

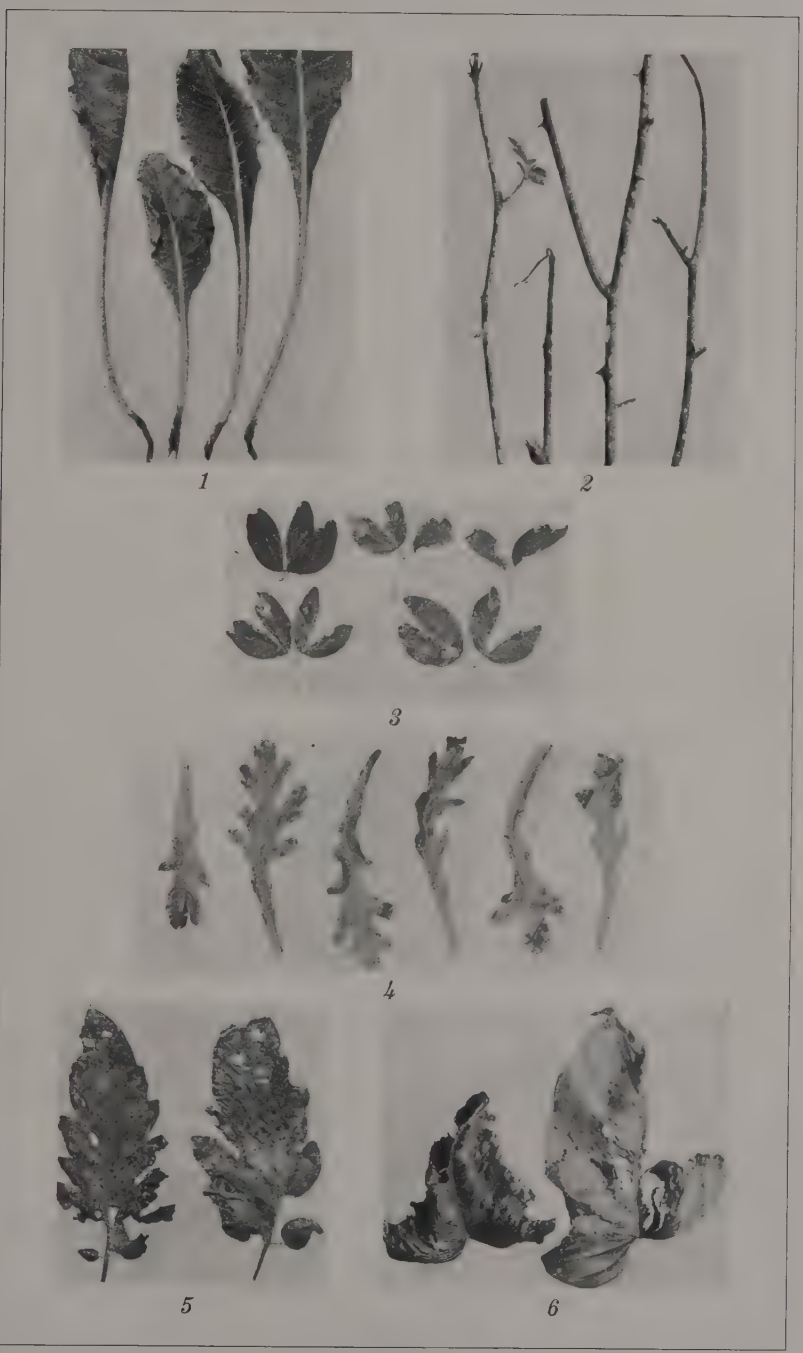


PLATE 1.

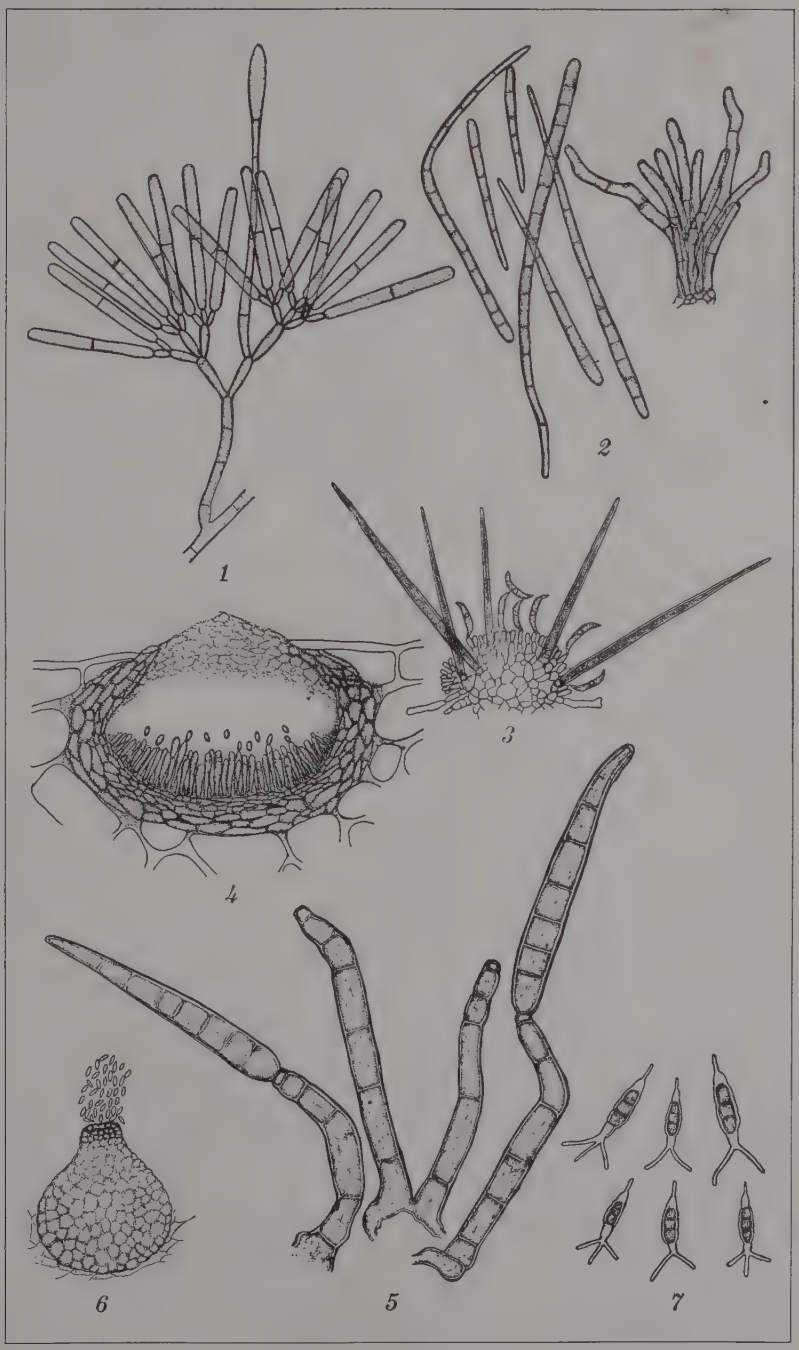


PLATE 2.

PHILIPPINE BAGASSE ASH AS A RAW MATERIAL FOR GLASS MAKING[1]

By SALVADOR DEL MUNDO

Of the Bureau of Science, Manila

TWO PLATES

The value of glass and glassware imported into the Philippines annually exceeds one million pesos. In 1934, for the period from January to August only, the imports of empty glass bottles and jars alone amounted to 359,640 pesos.[2] The life of many important industries depends on the solution of the glass-container problem. Breweries, distilleries, aërated-water factories, dairy farms, and drug stores are consumers of glass containers. A shortage in the supply of glass may seriously threaten the existence of these industries.

This paper is a preliminary report on investigations being conducted by the ceramics laboratory of the Bureau of Science to ascertain the suitability of Philippine sugar-cane bagasse ash as a raw material for the manufacture of glass.

The fibrous material obtained when sugar cane is crushed to extract the juice is commonly known as bagasse. In the Philippines baggase is regarded as a waste by-product. It is used exclusively as a boiler fuel in the power plants of sugar centrals. Since the calorific value of bagasse (about 8,300 B. T. U. per pound)[3] is relatively low, considerable quantities of this material are burned each season in the sugar-producing districts of the Philippines. During the season 1933 to 1934 about 4,466,198 long tons of sugar cane were reported as ground in seventeen sugar centrals.[4] Since about 24 per cent of the cane is bagasse and approximately 2 per cent of the material is ash, during this period about 1,072,888 tons of bagasse must have been produced which contained nearly 21,458 tons of ash.

[1] This paper was read at the general meeting of the Third Philippine Science Convention held February 28, 1935, under the auspices of the National Research Council of the Philippine Islands and the Philippine Scientific Society.

[2] Annual Report of the Insular Collector of Customs. Manila (1934).

[3] Ker, W. E., La. Exp. Sta. Bull. 117 and 160. Norris, R. S., Hawaiian Sugar Planters' Assoc. Exp. Sta. Bull. 40.

[4] Annual Reports of the Philippine Sugar Association. Manila (1930–1934).

TABLE 1.—*Quantity of sugar cane milled from 1926 to 1934 as reported by the Philippine Sugar Association.*

Year of crop.	Centrals reporting.	Gross cane ground.	Bagasse produced.	Ash.
		Tons.	*Tons.*[a]	*Tons.*[b]
1933–1934	17	4,466,198	1,071,888	21,438
1932–1933	22	5,107,776	1,225,855	24,517
1931–1932	20	4,311,760	1,034,822	20,696
1929–1930	28	5,944,727	1,426,734	28,534
1927–1928	17	4,250,591	1,020,142	20,402
1926–1927	17	4,064,698	975,528	19,510

[a] Computed on a basis of 24 per cent of gross cane ground.
[b] Computed on a basis of 2 per cent of bagasse produced.

TABLE 2.—*Analyses of bagasse.*

Constituent.	Philippine.		Formosan.
	Per cent.	*Per cent.*[a]	*Per cent.*[b]
Ash	2.11	4.73	2.40
Silica	1.86	----------	2.00
Fats and waxes	3.70	2.90	3.45
Lignin	18.90	17.49	19.95
Pentosans	25.30	22.98	24.50
Cellulose	47.01	49.86	46.00

[a] Average values of A. Valenzuela and A. P. West, Philip. Journ. Sci. **40** (1922) 279.
[b] H. Kumagawa and K. Shimomura, Zeitsch. für angewandte Chem. **36** (1923) 414.

Table 1 shows the quantity of sugar cane milled in the Philippines from 1926 to 1934 as reported by the Philippine Sugar Association. The probable production of bagasse and bagasse ash is likewise shown in Table 1. Table 2 gives a comparison of average approximate analyses of Philippine bagasse and average figures obtained for material produced in Formosa where analyses were made during a period of five years at the Giran Paper Mill of the Tainanseito Sugar Company.

Philippine bagasse ash is a friable material that is grayish to pink in color. When collected in those sections of the boiler furnace where the temperatures of combustion seldom exceed 900° C., the ash is usually grayish, owing to the presence of unburnt combustible matter. The bulk of this grayish ash consists of a powder that passes an 80-mesh screen almost completely.

The ash that accumulates in the hotter parts of the boiler furnace is known as fused ash in many sugar centrals. When this material is sifted in an 80-mesh screen, nearly 20 per cent of the ash passes through the sieve as a pinkish white powder (Plate 1, fig. 1). The residue retained on the screen consists

of pale green to faint blue clinkers and lumps. Many of these fused particles are from 0.5 to 1 centimeter in diameter (Plate 1, fig. 2). Some of them may be about the size of a chunk of coal (Plate 2, fig. 1). Fused bagasse ash is brittle and the lumps are readily crushed to a fine powder by a few turns in a steel ball mill.

The average specific gravity of bagasse-ash powder is 2.2. It is highly abrasive and people living in the neighborhood of sugar centrals employ the ash as a scouring material for household use. The only practical use that is now made of the ash in the Philippines is for filling low land and driveways. Sometimes the material is used as ballast on railroads. According to W. Scott,[5] a light paving brick can be made from bagasse ash by the use of a suitable press.

TABLE 3.—*Analyses of Philippine bagasse ash.*

Name of central.	Character of ash analyzed.	Loss on ignition	SiO_2.	Fe_2O_3.	Al_2O_3.
Pasudeco	Clinker and pinkish powder	0.1	89.1	1.3	2.8
Isabela	Grayish powder and light blue clinker	0.5	81.6	1.8	3.8
Del Carmen	Grayish powder	0.3	78.9	1.6	3.0
Paniqui Sugar Mills	Pinkish powder	0.3	80.8	1.4	2.7
Central Azucarera Tarlac	Grayish powder	0.5	79.9	1.5	2.8
Binalbagan Estate	Light green clinker, grayish powder	0.2	81.0	1.2	5.4
Calamba Sugar Estate	Fused lumps, pinkish powder	0.1	83.1	1.6	3.1
Maao Sugar Central	Grayish powder	0.5	77.5	0.8	6.2

Name of central.	Character of ash analyzed.	CaO.	MgO.	MnO.	Alkalies as K_2O.	Undetermined.
Pasudeco	Clinker and pinkish powder	2.6	1.5	0.05	2.4	0.2
Isabela	Grayish powder and light lue clinker	3.2	1.3	0.04	6.5	1.3
Del Carmen	Grayish powder	2.3	1.5	0.01	8.1	4.3
Paniqui Sugar Mills	Pinkish powder	2.2	1.6	0.14	7.8	3.1
Central Azucarera Tarlac	Grayish powder	2.3	1.4	0.05	7.4	4.2
Binalbagan Estate	Light green clinker, grayish powder	2.8	1.6	0.04	7.5	0.3
Calamba Sugar Estate	Fused lumps, pinkish powder	2.1	1.2	0.06	3.9	4.7
Maao Sugar Central	Grayish powder	2.7	2.0	0.03	7.5	2.8

In order to ascertain the average approximate composition of Philippine bagasse ash, as many samples of this material were analyzed as could be obtained from sugar centrals located in dif-

[5] Planter and Sugar Manufacturer 79 (1927) 368–381.

ferent districts of the Philippines. In Table 3 are shown the results of analyses made on material produced principally in Luzon. The figures given in Table 3 are average results of a number of analyses and therefore are about representative and typical for each locality. M. M. Alicante, of the Bureau of Science, in a study of the mineral constituents of bagasse ash in relation to juice qualities, has published analyses of material coming principally from sugar districts in the Visayan Islands.[6]

From the data given in this paper and the figures obtained by Alicante, it would seem that the average approximate composition of Philippine bagasse ash should be as shown in Table 4.

TABLE 4.—*Average mineral constituents in Philippine bagasse ash.*

Constituent.	Average analysis. Per cent.
Loss on ignition	0–1
Silica (SiO_2)	75–85
Iron oxide (Fe_2O_3)	seldom 2
Aluminum oxide (Al_2O_3)	4–8
Calcium oxide (CaO)	2–3
Magnesium oxide (MgO)	1.5–3
Manganese oxide (MnO)	less than 1
Potassium oxide (K_2O)	4–7
Phosphorus pentoxide (P_2O)	2–4

The variation in the composition of Philippine bagasse ash seems to be due more to differences in the heat of the boiler furnace than to differences in cane variety and place of origin. If the temperature of the furnace has been so high as to cause the ash to clinker and eventually fuse, the percentage of silica is somewhat higher than the average, while the percentage of alkalies which are volatile is comparatively low. According to P. de Sornay,[7] average analyses of such clinkers gave the following results:

De Sornay's average constituents of bagasse-ash clinker.

Constituent.	Per cent.
Silica (SiO_2)	88.30
Lime (CaO)	4.25
Phosphorus pentoxide (P_2O_5)	4.06
Potassium oxide (K_2O)	0.19
Undetermined	3.20
Total	100.00

When the ash has not been heated to incipient fusion, it is obtained as a coarse white powder which may be grayish or

[6] Annual Report, Res. Bur. Philip. Sugar Assoc. (1930–31).
[7] Rev. Agr. Maurice 3 (1926) 81.

pinkish in color according as it contains more or less unburnt combustible matter. This ash is usually low in silica and high in alkali. Its solubility in cold water may be as much as 2 per cent. In spite of differences in places of origin and in the variety of sugar cane from which the ash has been produced, and regardless of whether the material has been fused in the process of ashing or not, a striking uniformity may be observed in the percentages of iron oxide, alumina, lime, and magnesia of Philippine bagasse ash.

Bagasse ash is a good source of silica. The presence of this substance as a major constituent explains why the specific gravity of the ash is almost the same as that of sand. The high silica content also accounts for the abrasive properties of the ash. It might be thought that bagasse ash, being so rich in potash and phosphates, would make a good fertilizer, but it has been shown that the ashes are complex silicates formed at high temperatures and as such they are not appreciably soluble in water, so that the potash and phosphates contained in them are not available. The average solubility of Philippine bagasse ash in cold water is seldom more than 0.4 per cent. In dilute and moderately concentrated hydrochloric acid solutions, however, bagasse ash is appreciably soluble.

In view of the similarity in composition of Philippine bagasse ash and ordinary bottle glass, as may be seen from a consideration of Table 5, it occurred to the writer that a profitable way

TABLE 5.—*A comparison of the average composition of Philippine bagasse ash and different types of bottle glass.*[a]

Constituent.	Bagasse ash.	Bottle glass.[b]				
		Type 1.	Type 2.	Type 3.	Type 4.	Type 5.
Silica (SiO_2)	81.5	60.4	62.6	64.0	70.5	72.8
Aluminum oxide (Al_2O_3) + iron oxide (Fe_2O_3).	6.0	7.5	9.8	8.8	2.1	0.9
Calcium oxide (CaO) + magnesium oxide (MgO) + manganous oxide (MnO).	5.0	25.9	19.1	15.5	9.8	9.1
Sodium oxide (Na_2O) + potassium oxide (K_2O).	7.0	6.2	8.5	11.7	17.6	17.2

[a] Dralle, Die Glassfabrikation (1931) 1107.

[b] Type 1. Earliest type of bottle glass, for a long time used in France. Champagne bottles in Germany.

Type 2. Later type of German mouth-blown bottle glass.

Type 3. German Owens glass.

Type 4. American glass.

Type 5. White hollow glass and amber glass.

of disposing of this waste by-product would be to utilize it as a raw material in glass making.

Bagasse ash will rarely if ever fuse to a clear glass when heated alone, for the percentage of silica in the material is high while the lime and alkali are rather low. If these constituents of Philippine bagasse ash were adjusted to the proportions required for glass making, the silica content of the resulting mixture would still fall within the limits of glass-forming compositions.[8]

Table 5 shows that if a bottle glass high in lime should be wanted (types 1 and 2), only the lime content of Philippine bagasse ash need be corrected as the percentage of alkali would be sufficient in most cases. On the other hand, if a bottle glass high in alkali is to be made (types 4 and 5), the alkali content of the ash must be increased by additions of soda or potash. The lime content should also be slightly increased.

As a raw material for glass making, bagasse ash has certain advantages over the usual raw material, sand. This substance is chiefly composed of silica. Bagasse ash, on the other hand, contains nearly all of the other ingredients needed for glass making in addition to silica. These constituents of bagasse ash are not only present in proportions that need little modification, but they are also in intimate chemical combination.

Because of the hardness of its grains, sand is exceedingly difficult to grind to the mechanical consistency required in glass making. The grinding operation is seldom resorted to in the commercial preparation of sand for glass-making purposes. Instead, the sand is sorted and graded by flotation and sedimentation methods that are time-consuming and only practical where cheap running water is available. Bagasse ash is so loose and its particles so brittle that practically no trouble should be experienced in reducing it to any degree of subdivision to insure homogeneity in the batches and to avoid the formation of stones in the molten glass.

When sand is used as the principal raw material for the manufacture of common glass, the danger of failure from devitrification is almost always a constant menace to successful production. In order to overcome this difficulty, a common practice consists in increasing the molecular complexity of the batch by additions of kaolin or feldspathic materials that also increase the alumina content of the mixture. This procedure, however, in-

[8] Eitel, Pirani, Scheel, Glastechnische Tabellen (1932).

creases the cost of the production of glass, for these added minerals are not only expensive, but also tend to raise the melting point of the batch and to increase the viscosity of the molten glass to such an extent as to make refining difficult. Since bagasse ash is a silicate of a complex nature and has been fritted at the high temperatures of combustion in the boiler furnace, the danger of crystallization of molten mixtures containing this raw material is considerably minimized. Even if the alumina content of the ash were high, the batches made from it would still be of low melting point. These batches should not be hard to plain.

It might be supposed that the high percentage of iron in bagasse ash would exclude the possibility of making a light-colored glass from it. In most instances the glass produced is dark green. When, however, the percentage of manganese in the ash is appreciable, an emerald green glass of a pleasing color may be produced, as the violet of the manganese silicates neutralizes to a certain extent the complementary dark green due to iron.

In the course of preliminary experiments in the melting of glass batches made from bagasse ash, bottles were made which compared favorably in strength, appearance, and resistivity with the regular run of imported glass containers (Plate 2, fig. 2). Soft and medium-hard glass mixtures were included in these batches. They were melted in experimental furnaces, the largest of which consisted of an oil-fired day tank of a daily capacity of 150 kilos of glass.

A comparison of the resistance to the action of water below 100° C. of bottles made from bagasse-ash mixtures and similar imported containers is given in Table 6. The methods of Ped-

TABLE 6.—*Resistance of bottle glass made from Philippine bagasse ash to the action of water below 100° C.*

Bottle.	Milligrams of H_2SO_4 per 100 grams of glass.
Bagasse mixture 1	50.8
Bagasse mixture 2	44.5
Bagasse mixture 3	42.2
Bagasse mixture 4	38.3
Bagasse mixture 5	38.0
Milk bottle (imported)	31.3
Split bottle (imported)	23.8
Medicine bottle (imported)	66.4
Medicine bottle (imported)	47.1
Medicine bottle (made locally from "cullet" or broken scrap glass)	45.1

dle and Turner [9] were employed. Results are expressed in milligrams of sulphuric acid required to titrate the alkaline material extracted from 100 grams of pulverized glass by 100 cubic centimeters of water. The time of digestion is one hour at temperatures ranging from 80° to 100° C. The glass treated is previously reduced to a powder that passes a 20-mesh screen, but is retained on a 30-mesh sieve.

According to Peddle, glass to be useful should not show a sulphuric acid value of more than 100 milligrams per 100 grams of glass. When the sulphuric acid test gives more than 1,000 milligrams of H_2SO_4 per 100 grams of glass, the material tested may be considered useless.

Since the mechanical, thermal, and chemical properties of glass depend as much on the method of production as on the composition of the batch, it might be inferred that test figures on bottles made in small experimental furnaces and under laboratory conditions would differ from results obtained on products of actual manufacturing processes. A commercial furnace is, therefore, being constructed in this laboratory for the purpose of determining the properties of bottles made from Philippine bagasse ash.

In the Philippines there are deposits of silica (sand and sinter) suitable for glass making,[10] but their location and the excessive cost of transportation in these Islands make these deposits less desirable as a source of the prime raw material for the manufacture of glass than bagasse ash which is produced in sugar factories centrally located and readily accessible to excellent means of transportation.

The tonnage of bagasse ash produced in the Philippines yearly is so large that its disposal as a waste product is actually a problem. In the production of the ash the fuel value of bagasse is utilized, so that it will be realized that any effort to find a use for this industrial waste would meet an economic need and at the same time ameliorate the condition of the sugar industry which is actually undergoing a crisis on account of curtailed production.

[9] Trans. Opt. Soc. 23 (1921–22); Sprechsaal 55 (1922) 195; Journ. Soc. Glass Techn. 5 (1921) 195.

[10] Philip. Journ. Sci. 14 (1919) 467.

SUMMARY

The composition of Philippine bagasse ash is given in this paper. This by-product of the sugar centrals was found to contain a high percentage of silica. The other ingredients in bagasse ash were also found to be glass-making ingredients.

The following advantages may be claimed for bagasse ash as a raw material for the manufacture of glass:

1. The ash is a by-product of the sugar industry. A large tonnage of the material is available each season in sugar centrals that are readily accessible to excellent means of transportation.

2. The chemical composition of Philippine bagasse ash very closely resembles that of common mixtures for glass making. In many instances only minor corrections in the percentages of lime and alkali have to be made in the ash in order to obtain suitable glass batches.

3. The mechanical composition of bagasse ash makes it better suited as a raw material for glass making than sand, which because of the hardness of its grains is difficult to grind and grade to the proper state of subdivision required in glass making. Bagasse ash is so loose and its particles so friable that no trouble need be experienced in pulverizing the material to the required fineness. Batches from bagasse ash should therefore be more homogenous and capable of melting into a glass relatively free from stones and other defects caused by improper mixing of the raw materials.

4. Since bagasse ash is a complex silicate formed at high temperatures, there is less danger from devitrification of batches made from this material. Similar batches made from sand or siliceous sinter would, other things being equal, show a greater tendency to crystallize, unless costly ingredients are added to increase the molecular complexity of the mixtures.

5. In spite of the appreciable content of alumina in bagasse ash, batches made from this material were actually found to melt easily. No difficulty was experienced in refining glass made from Philippine bagasse ash.

We are installing a commercial furnace in the Bureau of Science for the purpose of making and testing bottles made from Philippine bagasse ash under actual manufacturing conditions.

ACKNOWLEDGMENT

To Mr. Wenceslao Trinidad, general manager of the Pampanga Sugar Development Company, obligations are acknowledged for calling our attention to bagasse ash as an industrial waste, and for a generous supply of raw material that helped in the performance of these investigations.

The author wishes to thank his assistants, Messrs. Elpidio C. Vera and Hector M. Moreno, for verifying a number of chemical analyses recorded in this paper.

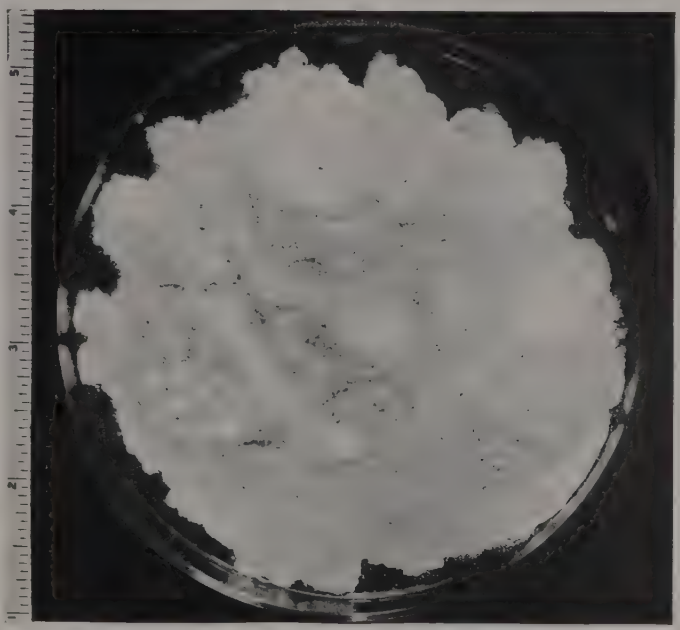
ILLUSTRATIONS

PLATE 1

FIG. 1. Bagasse-ash powder passing through an 80-mesh screen.
2. Bagasse ash as received from a sugar central.

PLATE 2

FIG. 1. A chunk of fused ash.
2. Bottles made from Philippine bagasse ash.



1

2

PLATE 1.

1

2

PLATE 2.

TWO MORE SPECIES OF THE GENUS STICTODORA LOOSS, 1899, IN THE PHILIPPINES, WITH DESCRIPTION OF A NEW SPECIES

By E. Y. Garcia and P. G. Refuerzo

Of the School of Hygiene and Public Health, University of the Philippines Manila

ONE PLATE

Since Looss erected the genus *Stictodora* for the species *S. sawakinensis* in 1899, no other member of this genus was found until Africa and Garcia (1935) described *Stictodora manilensis* from the small intestine of a Manila street dog. This genus was further enriched in the Philippines when the senior author encountered two more heterophyids with the unmistakable characters of this genus in the small intestine of dogs and several in the same organ of birds (*Larus ridibundus* Linn.) in the course of further autopsies that are being conducted on these animals in this laboratory. While one of them conforms to the description of *Stictodora sawakinensis* Looss, 1899, to which our material presumably belongs, the others present characters that seem to justify the naming of a new species. For this new *Stictodora,* the writers propose the name *Stictodora guerreroi* in honor of Prof. Luis Guerrero, head of the Department of Medicine, College of Medicine, whose keen interest in medical zoölogy and tropical medicine is well known to Philippine workers.

STICTODORA GUERREROI sp. nov. Plate 1, figs. 1 and 2.

The following description is based on the study of twenty-four adult specimens, two of which were obtained from the small intestine of a native dog, and the others from the same organ of birds (*Larus ridibundus* Linn.). They appear to be considerably smaller than *Stictodora manilensis.*

Body small, oblong, about 1.101 mm by 0.24 mm, all the reproductive organs contained in the enlarged posterior portion; cuticle spinous; œsophagus short; intestine simple tubes about as large as œsophagus in diameter, extending to posterior end of body. Ventral sucker could not be made out.

Female organs.—Ovary oval, 0.070 mm by 0.055 mm, in front of the right testis; receptaculum seminis between the testes; uterine coils fill the posterior half of body; vitellaria consist of rather small follicles arranged in transverse rows in the hind fourth of body.

Male organs.—Testes obliquely oval, placed obliquely one behind the other in the third fourth of body, posterior testis slightly larger, 0.112 mm by 0.080 mm, than anterior, 0.080 mm by 0.070 mm; vas deferens consists of three sacculations separated by short tubes located between the ovary and genital sac.

Genital sac transversely oval, 0.050 mm by 0.040 mm, preequatorial, occupied completely by the breadfruitlike protrusible gonotyl, of which the anterior two-thirds of the surface is covered by 25 to 28 circlets of simple slender spines (0.007 by 0.0018 mm), which are always perpendicular to the surface of the gonotyl. The number of spines that can be counted in each circlet in one optical plane varies from 60 to 64.

Excretory vesicle Y-shaped.

Eggs, 0.027 by 0.016 mm.

Specific diagnosis.—Body small, oblong, about 1.101 mm by 0.24 mm; intestinal cæca tubular, about as large as the œsophagus, extending to the posterior end of the body; ventral sucker invisible; testes obliquely one behind the other in the posterior part of the middle third of body; ovary anterior to right testis; seminal receptacle between the testes; uterine coils between genital sac and posterior end of body; genital sac occupied completely by a breadfruitlike gonotyl, the anterior two-thirds of which is covered by 25 to 28 circlets of minute slender spines; excretory bladder Y-shaped.

Hosts.—Native dog and *Larus ridibundus* Linn.

Location.—Small intestine.

Locality.—Biñang, Laguna Province, Luzon.

Type specimen.—Parasitological collection, Department of Parasitology, School of Hygiene and Public Health, University of the Philippines.

Remarks.—In comparing our present material with *Stictodora sawakinensis* Looss, 1899, and *Stictodora manilensis* Africa and Garcia, 1935, we find that they differ mainly in the structure of the gonotyl. In Witenberg's account the cone of the gonotyl of *S. sawakinensis* is described as having from six to ten longitudinal rows of triangular plates, and in *S. manilensis* the tip of the gonotyl bears a single circlet of large hooklets, which individually resemble the hooklets of *Tænia;* whereas in *Stictodora*

guerreroi the anterior two-thirds of the gonotyl is covered with from 25 to 28 circlets of numerous, simple, slender spines. As in *S. sawakinensis* as described by Witenberg, the ventral sucker is apparently absent, but we are inclined to believe that we have merely missed it in the present material since it has been found in *S. manilensis,* and there is evidence of its presence also in our specimen that we believe is *S. sawakinensis.*

STICTODORA SAWAKINENSIS Looss, 1899. Plate 1, fig. 3.

A lone specimen, which show characters of *Stictodora,* was recovered from the small intestine of a Manila street dog. A comparative study of this specimen with *S. sawakinensis,* which it resembles closely, revealed a minor difference between the two, the specific validity of which may be open to serious doubt, because after all it may be due to the manner of preservation. In *S. sawakinensis* the points of the triangular plates, as shown by Witenberg's text figure, are directed backwards or towards the base of the gonotyl, whereas in our material the tips of these plates are anteriorly directed, converging towards the tip of the gonotyl. Although the rudimentary sucker is present in the present material, just as it is in *S. manilensis,* we can hardly consider it a specific character, because it may be demonstrated in *S. sawakinensis.* For this reason, we refer our material provisionally to *Stictodora sawakinensis.*

SUMMARY

Two heterophyid flukes of the genus *Stictodora* from the small intestine of the dog and birds (*Larus ridibundus* Linn.), hitherto unknown in the Philippine parasitic fauna, are reported in this paper. One of these trematodes is new to science and is named *Stictodora guerreroi.* The other closely resembles *S. sawakinensis* and is provisionally referred to that species.

ACKNOWLEDGMENT

The writers are deeply grateful to Dr. Candido M. Africa, head of the Department of Parasitology, School of Hygiene and Public Health, University of the Philippines, for his suggestion to catch birds (*Larus ridibundus* Linn.) from which most of our specimens came, and for his patience in reading the manuscript.

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ILLUSTRATION

Plate 1

[Abbreviations: *exp*, Expulsor; *e*, egg; *gtl*, gonotyl; *oes*, œsophagus; *os*, oral sucker; *ov*, ovary; *rac*, rudimentary acetabulum; *rs*, receptaculum seminis; *t*, testis; *ut*, uterus; *vg*, vitelline glands; *vs*, seminal vesicle.]

Fig. 1. *Stictodora guerreroi* sp. nov., ventral view.
2. *Stictodora guerreroi* sp. nov., gonotyl, a close-up view.
3. *Stictodora sawakinensis* Looss, 1899, ventral view.

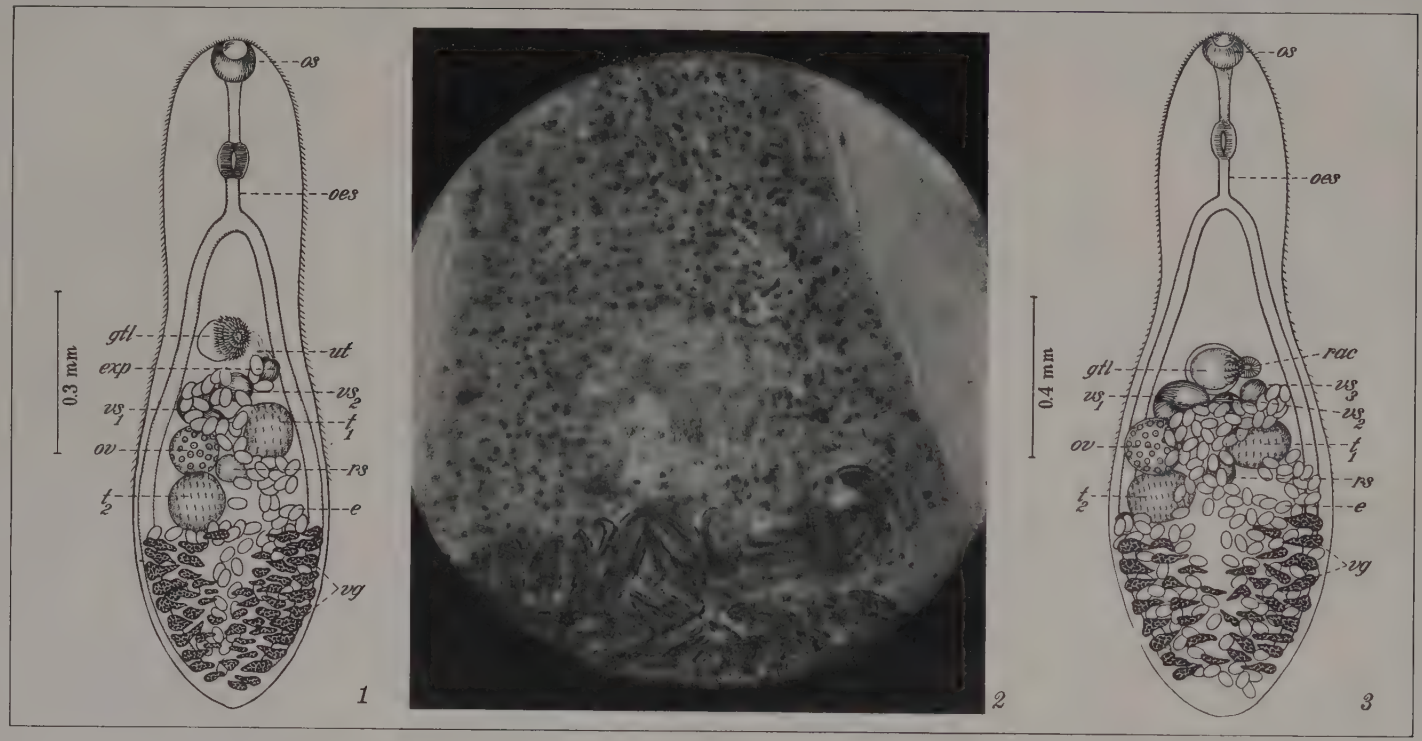
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PLATE 1.

LIFE HISTORIES OF SOME COMMON BIRDS IN THE VICINITY OF NOVALICHES, RIZAL PROVINCE LUZON, II

By Dioscoro S. Rabor

Of the Fish and Game Administration, Bureau of Science, Manila

This is a continuation of the studies on the life histories of some common Philippine birds in the vicinity of Novaliches, Rizal Province, Luzon.

The ecological conditions of the site of the present study are described in a previous paper (Rabor, 1936).

GUAVA BULBUL, PYCNONOTUS GOIAVIER GOIAVIER (SCOPOLI)

DESCRIPTION OF THE SPECIES

Adult.—The middle of the forehead and crown is seal brown, bordered on each side by a band of white which extends from the base of the bill, near the eye, to the side of the occiput, setting off clearly the black lores and ring around the eye. The general color above, including the wings and tail, is dark brown, with a fringe of olive or olive-yellow [1] to the individual feathers, clearest on the wing quills and rectrices. The ear coverts are brown; the spot below the eye, jaw, and most of the under parts, white. The individual feathers of the breast and sides have distinct brown shaft streaks giving a decidedly brownish tinge to these parts, becoming a uniform brown on the flanks and thighs. The abdomen has a pale yellow wash, becoming clearer in the posterior parts and decidedly changing to pure lemon yellow on the crissum. Likewise, the white axillars and wing linings possess a faint wash of yellow. The bill, legs, and nails are black. Five males average: Length, 198 mm; wing, 82; tail, 83; culmen, 16.5; bill from nostril, 9; tarsus, 21. Five females average: Length, 190 mm; wing, 82; tail, 85; culmen, 16.5; bill from nostril, 9; tarsus, 20.

There is no distinct sexual dimorphism in the adult of the species.

Young.—The young bird, as it leaves the nest, differs very slightly from the adult in plumage, although it is very much

[1] Contrast McGregor (1909) 516.

smaller with only a mere stub of a tail. The middle of the forehead and crown is dark brown, bordered on each side by a band of light brown extending from the base of the bill, over the eyes, to the sides of the occiput. Unopened or newly opened feathers are found on the lores and in the ring around the eye. Dorsally, including the wings and tail, the plumage is dark brown, the feathers on the back and rump being mostly decomposed. The ear coverts are brown with some feathers still unopened. In the head region the naked skin is still plainly visible owing to the deficiency of feathers, although the white of the chin and throat are already indicated by the scanty feathers on these areas. The breast, sides, and flanks are light brown, with the thighs naked except for two or three down feathers. The pale yellow of the abdomen changes to a decidedly pure lemon yellow on the crissum. The axillars and wing lining are pale yellow. The partly developed rectrices have the maximum length of 20 mm. The bill, legs, and toes are brown; the nails, flesh-colored. The white of the gape is rather distinct.

In about thirteen to fourteen weeks the young acquire the full plumage of the adult except for some scantiness in the feathering of the head. The whitish trace in the gape ultimately disappears.

DISTRIBUTION

The species is widely distributed in the Archipelago. Whitehead (1899) observed that it occurs throughout the entire group up to an altitude of 3,000 feet, "although it is one of the species that has not been met with in the Palawan group." McGregor (1909) gives the distribution as follows: Bohol, Caluya, Cebu, Guimaras, Leyte, Libagao, Luzon, Marinduque, Masbate, Mindoro, Negros, Nipa, Panay, Romblon, Samar, Tablas, Ticao, and Verde.

HAUNTS AND HABITS

The guava bulbul [*Pycnonotus goiavier goiavier* (Scopoli)] is one of the commonest of Philippine birds. It is known locally by various names, among which are "pulanga," "calaga," "luc-lac," "lac-lac" (Tagalog provinces); "palago" (Ticao); "curao" (Cebu); "piruca" (Ilocano provinces); and "culcul" in various provinces.

The species is very common about the bushes in open country, in second growth, and in thin forests. It is decidedly not a deep-forest form, preferring the outskirts of thick forests to the interior. The vegetation along the numerous creeks of the

vicinity under study, consisting mainly of mixed growths of bush, shrub, and tree, with their tangles of vines and creepers, provides an ideal haunt and feeding ground for the species.

Ordinarily, the birds fly about in groups of two to four, unquestionably the whole family—but never in regular flocks, although not infrequently five to a score feed in the same fruiting tree, bush, or creeper.

The feeding is always accompanied by a lot of singing, the birds giving the characteristic notes of the species as they go along with their work. The notes closely resemble the syllables "cul-cul-cul, etc.," "piruc-piruc-piruc, etc.," "luc-lac, luc-lac, etc.," given in various combinations. They seem to be restless, fluttering and chasing each other playfully from branch to branch, from tree to tree, but always within the same small radius of the food tree, unless disturbed. Not infrequently an individual is seen to cling momentarily and flutter around the flowering tip of a bush or tree branch, no doubt after the insects that feed on it. Although this bird is primarily a fruit-feeder, it is not uncommon to see individuals chasing butterflies, moths, bugs, and other insects on the wing, going to the nearest perch immediately after having caught them to devour them. Likewise, it is not rare to see the birds flying from a perch to the ground after grasshoppers and various kinds of ground insects, staying there often for as long as a minute or two, hopping now and then to locate and catch the victims, and flying to the nearest perch as soon as they have the prey secured.

The species has an unquestioned fondness for guavas (*Psidium guajava* Linn.).[2] A score or more are often seen feeding on the fruits in a small patch of this plant, clinging to them and pecking at the seeds, leaving only the fleshy pericarp attached to the tree.

The species does not fear the nearness of man; it frequents the immediate neighborhood of human habitations, including the garden where its nests are often built.

BREEDING HABITS

The species breeds from March to July, most abundantly in April and May. The latest record for the nesting of the species was June 25, when a nest with two fresh eggs was found.

The birds generally go about in groups, each group consisting of the whole family—the parents and the young of the season.

[2] Mr. Edilberto Karganilla, of the Bureau of Science, identified the plants mentioned in this paper.

The family is kept intact until the nesting season approaches, when the young separate and look for mates. There is evidence of the birds pairing for life.

A lot of chasing is done during the approach of the mating season. As the mating season progresses, the birds are seen in pairs, occasionally in groups of three, the excess bird possibly an unattached male. Ultimately a group of three birds is reduced to a pair—unquestionably the breeding couple. The male and the female feed together, from place to place, not far from the prospective nesting site. A pair that bred in the garden of the station (Bureau of Plant Industry Novaliches Mango Experiment Station) used to feed only among the plants in the garden and adjacent areas, within a radius of 100 meters from the nesting site.

Once in a while the birds of a pair chase each other as they feed, both birds flying very low. They keep on transferring from tree to tree, often going round and round in circles close to the nesting site. Apparently, the male is the pursuer. Sooner or later he catches up with the female, at which instant they close into a fluttering mass of feathers, maintaining this act until they are about to fall to the ground. All these reactions occur on the wing and are repeated frequently. The phenomenon is more pronounced and more frequent when the nest is ready for the reception of the eggs. Obviously, this is the method of copulation in the species.

The nest is typically a fairly shallow cup, moderately compact in structure with a tendency to flimsiness. The sides consist of roots and stems of grasses, weeds, and creepers, lined with fine, fiberlike, aërial roots. A layer of leaves of bamboo and other plants is invariably placed at the bottom, immediately below the inner lining. Measurements of twenty-four nests of the species were: outside diameter, 90 to 107 mm; inside diameter, 60 to 72; inside depth, 37 to 52; and outside depth, 52 to 73 mm.

The nesting sites vary a great deal but generally the species seems to prefer small or low trees, saplings, shrubs, or bushes growing in the open, in fairly thick vegetation near clearings, and in vegetative clusters of moderate thickness growing along the numerous creeks of the vicinity. Nests have never been observed in the thick part of very dense vegetative growths. Grant and Whitehead (1898), commenting on the nesting sites of the genus, wrote that the "nests are generally on the edge of the forest or in some isolated bush in old clearings." Of twenty-

four nests studied the majority were placed low (0.3 to 3 meters) in low or small trees, saplings, shrubs, bushes, or creepers growing in situations described above. Whitehead (1898) noted a nest of the species that he found in Paranas, Samar, as "cup-shaped, built of fine roots, and placed in a low tree about 5 feet from the ground in an open situation." Present observations hold his short description as typical for the nest of the species. One nest was found in a rather unlikely site, being snugly placed in the center of a cogon-grass tussock about 30 cm from the ground, supported by the stiff basal parts of the cogon leaves. The same peculiar site was noted by Hopwood (Stuart-Baker, 1932) in his observations on the nesting of the closely related subspecies, *Pycnonotus goiavier personatus* Hume, of peninsular Tenasserim and Siam, the Malay States, and Sumatra. Not infrequently the nests are situated in sites without the least attempt at concealment, so that the most casual observer cannot help but find them.

The normal clutch is two or three eggs, both numbers about equally represented in the various sets studied, although clutches of four are not rare; Steere (1888) collected such a set in Marinduque. Four of the nine sets of eggs gave two as the full complement, the remaining five nests gave three. However, two nests contained two young as the full complement and one nest had three young when discovered.

The egg is typically ovoid; a few eggs are ellipsoidal, while others are long regular ovals.

The color and markings vary a great deal. The ground color ranges from pale pink to pinkish white. In most eggs the markings consist of numerous tiny mottlings of pale red or reddish brown, scattered thickly over the whole surface, most often more numerous at the larger end, frequently forming a ring or cap on that part. In addition to these primary markings the egg has at some places underlying blotches of pale or grayish lilac. These undermarkings vary a great deal in intensity, in some being sparse, and in others so numerous as to give a purple-gray tint to the broader end. In some eggs the markings form very definite rings and caps at the broad end. The shell is fine in texture and possesses a faint gloss.

Twenty-three eggs average 20.9 by 15.8 mm; maxima, 21 by 16.5 and 16 by 23 mm; minimum, 20 by 15 mm. An egg, also from Novaliches, Rizal, in the collection of the Bureau of Science, measures 24 by 15 mm and is an exceptionally long oval.

Incubation takes thirteen days. The bird sits very close and does not flush from the nest unless approached dangerously near.

Both sexes have been shot in the nest; evidently, the male and female share in the duties of incubation. The young leave the nest in twelve to fourteen days.

The newly hatched nestlings are tiny, naked, and helpless, with the eyes still closed. The reddish skin is very transparent, and the internal organs are visible in the abdominal region. The whole period that the young stay in the nest is characterized by fast and continuous growth; however, even when they leave the nest they have not yet attained the full size of the species.

Indications of feathers can be found in the wings and some parts of the dorsal pterylæ as early as the fourth day after hatching. At about this time the eyes open, but are very tiny apertures. The young present a very bristly appearance at about the sixth day. The complete plumage develops by the eleventh or twelfth day, after which time the young are able to leave the nest and search for food with the parents.

Both sexes brood the young. During the first five days after hatching the parents do not leave the nestlings, unless forced to do so by intruders. At least one of the parents stays in the immediate vicinity of the nest, perhaps to keep up the brooding of the young. At this stage the parent birds are seemingly unafraid of human intrusion. They usually stay near by, not necessarily within sight but always within hearing, as one can easily hear them keeping up an incessant protesting murmur among the foliage of the nest plant or very near it.

The parents leave the nest oftener when the young ones have already their partial coats of feathers, although one of them is always near by, perhaps to give warning to the young at the approach of danger. In several instances, the young ones were observed lying low and motionless in the nests, while one unseen bird (apparently one of the parents) kept up an incessant murmuring protest in the neighborhood. When about to be handled or when touched they seemed to shrink still closer to the nest bottom.

The nestlings of the species, like other nestlings, are voracious feeders. The parents keep up an incessant search for food in order to satisfy their never-ending hunger. A couple with two 6-day-old nestlings was observed to get caterpillars from a "sinigüelas" (*Spondias purpurea* Linn.), at an average of one in five minutes. This was kept up for about an hour, after which time both birds came to the tree and fed on the

caterpillars themselves. They fed and played for about fifteen minutes, and then went to the nest with caterpillars in the bill. Immediately after, the birds resumed their work. Another nesting couple was observed to come for the fruits of a creeper at an average of one visit in three minutes. At times the parents went together, then, by turns.

The young birds upon leaving the nest go with the parents to feed. The nearest fruiting tree is generally chosen. Both parents then proceed to feed the young, who seem to wait for this parental help, without in any way trying to peck at the fruits themselves. Perhaps they have not yet learned to peck at the fruits. The young birds keep on making the helpless begging note.

A feeding family, if approached, offers an interesting study of avian parental care and behavior. The parents upon seeing the intruder immediately fly to the nearest neighboring bush or tree, at the same time keeping up the warning cries. They are restless as long as they see the intruder near the young. They keep hopping from limb to limb, fluttering now and then, round and round the cover, but not leaving it unless sure they are being followed. Upon sensing that the intruder keeps following them, they immediately flutter to another cover, still farther from the young. They keep this up until they succeed in leading the intruder away from the young ones.

The young ones in turn, upon sensing that danger is near, keep silent and remain motionless. If surprised on a naked perch, they maintain the same rigid position, but transfer to more leafy parts as soon as they are sure that they are not watched. Here they stay as long as the parents continue the warning calls. If the observer effectively conceals himself from the parents, the warning notes cease. Soon afterwards the young will hop about and resume the characteristic begging call for food. The parents come to them right away, and the process of feeding is resumed. When either of the parents discovers the trick, they leave again. The young have the same characteristic protective reactions as previously observed.

Young birds of the season, about seven weeks old, with only a trace of white in the gape, were observed being fed by the parents once in a while in addition to feeding themselves.

The species, in spite of all the seemingly conscious protective reactions, suffers a great deal from predators, chief among which are the traditional bird enemies; namely, the monitor lizard [*Varanus salvator* (Laurenti)], the crow (*Corvus philippinus* Bona-

parte), and the civet cat (*Paradoxurus philippinensis* Jourdan). The apparent carelessness in placing the nest in very accessible places is mainly responsible for the heavy mortality of the species due to natural enemies. Of twelve sets studied, representing both eggs and young, only six sets, or 50 per cent, were successfully reared to the time of voluntary flight from the nest. Three of the six unsuccessful sets were destroyed when still unhatched, and the remaining three as nestlings. In one peculiar case two nestlings were destroyed by a house dog, as the nest, carelessly placed low in a small jack tree [*Artocarpus integra* (Thunb.) Merr.] in a garden, was within its reach. While it is true that too few sets have been studied to warrant conclusive figures, the very low percentage of successful rearing of nestlings from them is an index to the probable rate of mortality suffered by the species.

GOLDEN-HEADED CISTICOLA, CISTICOLA EXILIS RUSTICA WALLACE

DESCRIPTION OF THE SPECIES

Adult.—There is a well-marked sex dimorphism in the adult of the species, which becomes more pronounced during the breeding season.

The male in breeding plumage has the crown of the head uniform golden buff, becoming a little dingy towards the nape and hind neck. The lores and feathers around the eye are buff, becoming whitish on the ear coverts. The cheek to the side of the neck is golden, ranging to reddish buff. The general color above is ashy gray with broad blackish streaks to the feathers of the mantle and a wash of deep tawny on the lower back, rump, and upper tail coverts. Below, including the thighs and crissum, the plumage is heavily washed with tawny or reddish buff, deepest on the breast, sides, and flanks and lightest on the middle of the breast. The primaries and outer secondaries are light brown, becoming blackish brown on the inner secondaries. All the wing feathers are more or less edged with ashy or ashy fulvous, more distinct in the inner secondaries. The rectrices are blackish with deep buff tips.

The iris is light brown; the legs, feet, and nails flesh-colored. The bill has the upper mandible dark brown and the lower mandible flesh to pinkish brown. The male assumes this type of plumage from May to August.

The female differs from the male in having broad black streaks to the fulvous-brown feathers of the head, this fulvous-brown color extending to the nape, and to hind neck with an ashy shade.

The upper tail coverts are likewise fulvous-brown; in other respects, the female closely resembles the male. The female possesses a fixed type of plumage throughout the year.

The male in nonbreeding plumage closely resembles the female in having the crown feathers streaked with black, with the underparts mostly white. The male assumes this type of plumage during the other months of the year.

McGregor (1909), quoting Bourns and Worcester, gave as the average measurements for three males, "Length, 90 mm; wing, 40.6; tail, 35.5; culmen, 11.6; tarsus, 17; middle toe with claw, 14. Two females, length, 97; wing, 40; tail, 36.5; culmen, 12; tarsus, 18; middle toe with claw, 15."

Young.—The young bird just flown from the nest is very similar to the female in plumage, except that it has a tendency to be a little browner and its underparts are washed with pale yellow, clearest on the face, throat, and breast.

The iris is the same as in the adult but the bill, legs, feet, and nails are a little bit paler than the corresponding colors in the adult. The whitish gape is rather distinct.

DISTRIBUTION

The species is found in most of the islands of the Archipelago. Whitehead (1899) observed that it was "more common and more widely distributed over the Philippines" than its congener, *Cisticola juncidis mcgregori* Hachisuka.

McGregor gives the distribution as follows: Bantayan, Bohol, Calamianes, Caluya, Cebu, Leyte, Lubang, Luzon, Marinduque, Masbate, Mindanao, Mindoro, Negros, Panay, Romblon, Samar, Semirara, Sibay, Sibuyan, Siquijor, Sulu, Tablas, and Ticao.

HAUNTS AND HABITS

The golden-headed cisticola (*Cisticola exilis rustica* Wallace), known locally as "pipit-cogon" (Tagalog) or "pirot" (Visayan), is common in wide stretches of grassland, notably deep grass such as cogon [*Imperata cylindrica* (L.) Beauv.] and talahib (*Saccharum spontaneum* Linn.) Whitehead (1899) observed that "in Luzon it is plentiful on the lalang grass-covered hills." The wide open tracts of high grass in the vicinity under study provide an ideal haunt and breeding site for the species.

The bird is not shy, even allowing one to approach to within 2 or 3 meters, while it keeps on its warblings unconcernedly from a perch which may be a high grass stem, a bush, a shrub, or a low tree growing in the open, or even high on the naked

top of a bamboo bordering a grassy tract. When disturbed it flies jerkily straight into the air, then proceeds strongly and well for about 25 meters or a little farther before it hurls itself headlong into the grass, immediately disappearing among the stems to resume its search for insect food.

The note closely approaches the syllables "tweek-tweek-chur-r-r," repeated after distinct intervals, the last syllable very closely resembling the note of a big katydid (*Pseudophyllus* sp.). An observer may be listening to the notes of one without being able to ascertain exactly just where the small singer is, although it may be perching rather conspicuously near by. It has the ability to throw its voice so the note will seem to come from an entirely different direction.

BREEDING HABITS

The species apparently breeds in May, June, July, and August among the more or less open tracts of deep grass in Novaliches and vicinity. The character of the nesting site makes it difficult to discover the nest. In many instances couples were flushed from possible nesting sites and were observed to behave in a way characteristic of nesting. Couples were flushed from certain definite sites, day after day, and at different hours of the day, and whenever they were disturbed, they were wont to exhibit a considerable degree of hesitancy and loathing to leave these particular sites. An observer would not hesitate to ascribe these reactions to nesting, yet careful search for the nest in these places failed to reveal it.

Couples were commonly observed chasing each other among the high grass, sometimes flying jerkily over them for short distances before settling into the thick growth where they would disappear. These couples were observed repeating from time to time the same chasing reactions. The male seemed to initiate the activity each time. Apparently the reaction is part of mating. Whether or not copulation took place at the end of each chase I could not ascertain. It should be noted, however, that sounds characteristic of struggling among the grass stems were always heard in those spots where the chasing couples disappeared. In one instance two birds chased each other straight into the air up to a great height, both individuals flying erratically and aimlessly. Now and then the female made sharp turns; now, sharp angles; then flew straight and still higher. The female seemingly made her course purposely erratic in order to avoid being overtaken by the male. Three times the male

overtook her, and each time both birds suddenly merged into one fluttering mass falling a few meters below the previous height, only to separate, rise, and continue to chase each other. Ultimately both birds hurled themselves into a cogon patch about 100 meters away. Copulation must have been accomplished every time the couple closed.

A nest with one fresh egg was found by sheer accident June 3. While I was traversing an open slope, in which cogon, sambong [*Blumea balsamifera* (Linn.) DC.], and tamo [*Curcuma zedoaria* (Berg.) Rosc.] grew profusely, a bird suddenly whirred from under me and perched on top of a bush about 5 meters away. It immediately commenced to sing. It was a female golden-headed cisticola. I looked down and hardly a foot away I saw its beautiful nest. One more step and I would very likely have destroyed it!

The nest was so cleverly placed among the cogon, tamo, and sambong that from just a meter away it was inconspicuous.

The egg-shaped nest, placed 0.3 meter from the ground, was made of cogon leaves, cleverly intertwined and woven together to form a rather semicompact structure. Through the oval opening, which was situated on the upper two-thirds of one side, could be seen the thick cozy lining of downy, white cogon fruits, which extended to the dome. The grass leaves were bound together with spider webs and cocoon threads, materials that also attached the nest partly to the stem of a small sambong plant and partly to a few cogon leaves of a near by clump. Living leaves of the sambong were cleverly pasted and held in place by spider webs and cocoon threads at the back and over the entrance of the nest, rendering it very inconspicuous from all angles.

The moderately spotted and speckled eggs were short ovals with one end rather slightly more pointed than the other. The ground color was pale blue, although in the very fresh egg a very faint tinge of green could be detected. The chocolate-brown spots and speckles, rather sparse, had a tendency to be a little denser on the broad end. The shell was moderately fine in texture and possessed a faint gloss. The eggs closely resemble the Formosan specimens described by Oates and Reid (1905).

The full complement was three, the eggs being laid at intervals of about twenty-four hours. The three eggs measured 15.0 by 11.2 mm; 15.5 by 11.0; and 15.7 by 11.5.

I flushed the female from the nest every time I visited it for observation. She had the habit of perching on top of a small tree about 20 meters away, and from there gave forth her protesting notes.

In the present study incubation took twelve days. Whether or not the male took part in incubation I could not ascertain as I never had a chance of seeing him near by, although, very likely, he might have been staying among the deep grass all the time. The female usually flushed when I was about 5 to 7 meters away and usually covered by one side of the slope. Apparently she is shy and not a very close sitter.

The newly hatched nestlings were naked and very tiny. As early as the second day, darkening of the pterylar tracts had already begun. On the fourth day the nestlings presented a bristly sight with the partly opened and unopened feathers sticking out. About the tenth day the plumage, except that of some underparts, was more or less complete.

The young left the nest in twelve days. I could not find any trace of them in the same site or near it, immediately after they left the nest, although adult birds were rather a common sight on the grassy field opposite.

SUMMARY AND CONCLUSIONS

1. The life histories of the guava bulbul, *Pycnonotus goiavier goiavier* (Scopoli) and golden-headed cisticola, *Cisticola exilis rustica* Wallace, were studied in the vicinity of Novaliches, Rizal Province, Luzon.

2. The guava bulbul, widely distributed throughout the Archipelago, is common about the bushes in open country, in second growth, and in thin forests, and in the vicinity of thick forests prefers the outskirts to the interior. The birds ordinarily fly about in groups of two to four (apparently the whole family), during the nonbreeding months; they go about in pairs during the mating season. They do not fear the nearness of man, being fond of feeding in his garden and even nesting there.

3. The breeding season of the species is from March to July, reaching its height in April and May.

4. Apparently the same birds pair throughout life until one parent is gone, in which case the remaining bird pairs with some unattached individual of the same feeding group.

5. Copulation takes place on the wing, while both birds are flying low.

6. The nest, typically a fairly shallow cup moderately compact in structure with a tendency to flimsiness, has sides of roots and stems of grasses, weeds, and creepers, and is generally lined with a layer of fine fiberlike aërial roots.

7. The nests are usually placed low (0.3 to 3 meters) on small or low trees, saplings, shrubs, or bushes growing in the open or in the outskirts of thick vegetative patches commonly bordering creeks. Not infrequently nests are placed in conspicuous places, without the least attempt at concealment, resulting in a rather high mortality of the young.

8. The typically ovate eggs, usually two or three in a clutch, have a pale pink to pinkish white ground color, heavily mottled with numerous tiny spots of pale red or reddish brown and underlain at some places with blotches of pale gray or grayish lilac. The shell, fine in texture, possesses a faint gloss. Twenty-three eggs average 20.9 by 15.8 mm.

9. Incubation takes thirteen days, with both parents participating.

10. The young leave the nest in twelve to fourteen days, with both parents brooding and taking care of them.

11. The parents continue to take care of the young until they have attained all adult characteristics except the gape, which has still the whitish trace characteristic of juvenile individuals.

12. The golden-headed cisticola, found in most of the islands of the Archipelago, is common in the wide stretches of deep grass, such as cogon [*Imperata cylindrica* (Linn.) Beauv.] and talahib (*Saccharum spontaneum* Linn.).

13. The species breeds in May to August in patches of deep grass, making the nest difficult to locate.

14. One nest was an egg-shaped structure of cogon leaves with a lining of cogon downy fruits. It was placed low (0.3 meter) among the cogon, sambong [*Blumea balsamifera* (Linn.) DC.] and tamo [*Curcuma zedoaria* (Berg.) Rosc.] that grew profusely in the site. It was attached to the sambong and cogon by spider webs, the leaves of the former effectively concealing it.

15. The eggs, three in the clutch, were short ovals with a ground color of pale blue faintly tinged with green and sparsely mottled and speckled with chocolate brown. The shell, moderately fine in texture, possessed a faint gloss.

16. Incubation took twelve days. The female, rather a shy sitter, was always flushed from the nest.

17. The young left the nest in twelve days.

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A REVIEW OF PHILIPPINE PIGEONS, III
SUBFAMILY TRERONINÆ

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The nature of this paper is similar to that of the preceding numbers of this series.[1]

The difficulty of dividing the pigeons into definable groups has been experienced by systematists that have had occasion to study them. This is evidenced by the several schemes for the classification of the smaller groups. Obviously, the homogeneity of the group causes the trouble.

The Treroninæ, like other Columbidæ, has been variously divided, and the number of genera composing this subfamily differs with the systematists. Available material and literature tend to show, however, that this subfamily consists of sexually dimorphic, arboreal, thick-billed green pigeons whose wings have yellow bands, the third primary deeply scalloped in the middle of its inner web, the rectrices fourteen, and the under tail coverts nearly reaching the tip of the tail.

A résumé of the Philippine genera previously considered under the subfamily Treroninæ will show, as in other divisions of the pigeons, the confusion arising in the formation of a distinctly natural group.

Bonaparte (1854) indicated that under the subfamily Treroninæ are the genera *Sphenurus, Treron, Osmotreron,* and others, all with fourteen tail feathers.

Salvadori (1891) reviewed the literature on pigeons published prior to his time. In his scheme he included in the Treroninæ pigeons with rather thick bill, plumage mostly green and generally with a yellow band on the wing. The genus *Phapitreron* fits this only with regard to its bill. With other genera, *Sphenocercus, Osmotreron, Treron,* and *Phapitreron* were named by Salvadori in the subfamily Treroninæ.

[1] Philip. Journ. Sci. 59 (1936) 289–305 and 327–336.

McGregor (1909) used the third primary, which is scooped on the middle of its inner web, as a diagnosis for the subfamily Treroninæ, but excepted *Phapitreron* in that regard.

Oberholser (1912) showed evidence of the priority of *Dendrophassa,* 1842, to *Osmotreron,* 1854, and believed there is no reason for rejecting the former name.

Stuart Baker (1913) in treating the doves and pigeons of India listed *Osmotreron, Treron,* and *Sphenocercus* under the subfamily Treroninæ.

Hartert and Goodson (1918) united *Osmotreron, Vinago,* and *Treron,* contending that "the extent of the naked cere or base of bill is merely a specific character." They remarked "that *Osmotreron* cannot possibly be separated from *Treron,* or else *Dendrophassa* would have to be the name, antedating *Osmotreron* by twelve years."

Hartert (1927) explained the possibility of systematists even considering *curvirostra* (species of *Treron*) and *pompadora* (species of *Osmotreron*) of subspecific rank on the basis of the bare "cere" which ranges from a short to a long one. He added that "the generic separation of *Treron* and *Osmotreron* cannot, however, be possibly admitted."

Stuart Baker (1928) in preparing the fauna of British India listed *Dendrophassa, Treron,* and *Sphenocercus* with two other genera under the subfamily Treroninæ.

Using the length of the under tail coverts that reach well beyond their toes and their generally small size, Hachisuka (1932) classified *Sphenurus, Treron, Phapitreron, Leucotreron, Neoleucotreron, Ptilinopus,* and *Haemataena* under the subfamily Treroninæ. *Osmotreron* was lumped with *Treron.*

Chasen (1935), in naming the Malaysian birds, retained the genus *Treron,* obviously for the genera *Treron* and *Osmotreron.*

It should be understood that the arguments presented by Hartert in uniting *Osmotreron* with *Treron* are based on his studies of a sufficiently large number of specimens from many regions. The genus *Sphenurus,* except for its slightly larger size and longer tail, also closely resembles the genera *Treron* and *Osmotreron.* Thus, it may not be surprising if further studies would result in the fusion of *Sphenurus* and *Treron.* For the moment, however, the genera *Treron* and *Sphenurus* are here admitted as Philippine representatives of the subfamily Treroninæ.

Key to the genera of Philippine Treroninæ.

a^1. Tail graduated, more than 120 mm long..... *Sphenurus.*
a^2. Tail rounded, less than 110 mm long..... *Treron.*

Genus SPHENURUS Swainson, 1837

Hard rhamphotheca bridged from frontal feathers by a maxillary depression. Resembles certain species of *Treron* but larger, darker colored, and the tail longer and graduated.

One race is known in the Philippines.

SPHENURUS FORMOSÆ AUSTRALIS (McGregor).

Sphenocercus formosæ McGregor, Bull. Philip. Mus. 4 (1904) 9.
Sphenocercus australis McGregor, Philip. Journ. Sci. § A 2 (1907) 344–345.
Sphenurus formosæ australis Hachisuka, Contrib. Birds Philip. No. 2 (1930) 170–171.

Batan, Calayan, and Camiguin Norte.

Specimens from the three islands named above were examined.

Measurements of Sphenurus formosæ australis based on 9 males and 3 females.

	Extremes. mm.	Mean. mm.
Wing	189–203	193.1
Tail	131–144	133.3
Culmen	18– 19	18.9
Tarsus	25– 26	25.9
Middle toe with claw	34– 39	36.4

This race was first recorded by McGregor (1904) from Calayan as identical with the Formosan form. After examination of the materials from Camiguin Island which he obtained later, he came to the opinion that the Philippine specimen is different from that of Formosa to which it is closely related. McGregor (1907) named the Camiguin form *Sphenocercus australis* and remarked that the Calayan birds which he recorded as *Sphenocercus formosæ* must be referred to *S. australis*.

Hachisuka (1930) indicated the subspecific rank of this form for the first time and called it *Sphenurus formosæ australis*.

In view of the fact that *Sphenurus* Swainson (1837) antedates *Sphenocercus* Gray (1840), the former is the valid generic name. McGregor (1907) clearly indicated that "this species (referring to *S. australis*) is nearly related to *S. formosæ*." Unfortunately, no specimen from Formosa had been examined in the present study. On this account and on the authority of McGregor's statement quoted above, Hachisuka's nomenclature is, for the present, followed in this paper.

Genus TRERON Viellot, 1816

Resembling *Sphenurus* but smaller, more brightly colored and the tail rounded. In some species, the hard rhamphotheca is extended to frontal feathers.

Three species with four subspecies are recorded in the Philippines.

Key to the species of Philippine Treron.

a^1. Hard rhamphotheca reaching feathers of forehead..... *curvirostra.*
a^2. Hard rhamphotheca separated from forehead by a distinct maxillary depression.
b^1. Larger, wing 160 mm or more, mantle of male maroon.. *pompadora.*
b^2. Smaller, wing 150 mm or less, mantle of male not maroon.... *vernans.*

TRERON CURVIROSTRA ERIMACRA Oberholser.

Treron nasica SHARPE, Trans. Linn. Soc. London (Zool.) 1 (1879) 346.
Treron nipalensis SALVADORI, Cat. Birds. Brit. Mus. 21 (1893) 34–37.
Treron curvirostra erimacra OBERHOLSER, Journ. Wash. Acad. Sci. 14 (1924) 297.
Treron curvirostra curvirostra HARTERT, Nov. Zool. 34 (1927) 2.

Mindoro, Palawan, and Balabac Islands.
Specimens from Palawan were examined.

Measurements of Treron curvirostra erimacra based on 12 males and 3 females.

	Extremes. mm.	Mean. mm.
Wing	132–141	135.83
Tail	85– 92	88.66
Culmen	13– 14	13.60
Tarsus	22– 23	22.66
Middle toe and claw	28– 30	28.17

The bird was first collected by Steere and named by Sharpe (1876) as *Treron nasica* because of its similarity to the Sumatran form that bears this name. Salvadori in preparing the catalogue of pigeons in the collection of the British Museum classified this as *Treron nipalensis,* but acknowledged that together with that from Malay Peninsula, Sumatra, and Borneo, this form is smaller and duller than that from Nepal and Tenasserim. Oberholser (1912) indicated that *Columba curvirostra* is the oldest name for this form and showed why *Treron curvirostra* should replace *Treron nipalensis.* In a later publication, Oberholser (1924, p. 297) named the Philippine race *T. c. erimarca.* Hartert (1927, p. 2) indicated the occurrence of "*T. c. curvirostra* (or near subspecies), and *T. pompadora axillaris* in the Philippines," the former undoubtedly meant to be *T. c.*

erimacra. Hachisuka (1930) listed *Treron nipalensis nasica* as a Philippine form. Without explanation, but perhaps impressed by Hartert's nomenclature, which must have been noted later, he (1932) used *Treron curvirostra curvirostra* for obviously the same bird. Inasmuch as a new name is required for the Philippine form and as the name introduced by Oberholser for the Philippine race has not been invalidated, that should stand unchanged.

TRERON POMPADORA AXILLARIS Bonaparte.

Treron axillaris BONAPARTE, Compt. Rend. 39 (1854) 875.
Osmotreron axillaris WALDEN, Trans. Zool. Soc. London (1877) 211.
Treron pompadora axillaris HARTERT, Nov. Zool. 34 (1927) 2.

Bantayan, Basilan, Catanduanes, Cebu, Dinagat, Guimaras, Lubang, Luzon, Masbate, Mindanao, Mindoro, Negros, Panay, Polillo, Romblon, Samar, Semirara, Sibay, Siquijor, Tablas, Tawitawi, Ticao, and Verde.

Specimens from Alabat, Basilan, Biliran, Cebu, Lubang, Mindanao, Mindoro, Negros, Panay, Polillo, Romblon, Samar, Siquijor, Tablas, Ticao, and Verde were examined.

Measurements of Treron pompadora axillaris based on 23 males and 20 females.

	Extremes. mm.	Mean. mm.
Wing	160–167	162.83
Tail	95–100	96.64
Culmen	17– 19	17.77
Tarsus	23– 24	23.82
Middle toe and claw	30– 33	31.87

The Philippine form was originally described as *Treron axillaris.* Hartert (1927) lumped all the allied forms into the species *pompadora* and designated the present race *T. p. axillaris.*

TRERON POMPADORA EVERETTI (Rothschild).

Osmotreron axillaris SALVADORI, Cat. Birds Brit. Mus. 21 (1893) 48–49.
Osmotreron everetti ROTHSCHILD, Nov. Zool. 1 (1894) 41.
Treron pompadora everetti HARTERT, Nov. Zool. 34 (1927) 2.

Bongao, Meimbun, Sibutu, and Sulu.

One specimen from Bongao was examined.

The yellow tinge of neck, chin, throat, and breast of this specimen is brighter than in the corresponding parts of *T. p. axillaris.* Wing, 160 mm; tail, 95; culmen, 17; tarsus, 22.

TRERON VERNANS VERNANS (Linnæus).

Columba viridis philippinensis BRISSON, Orn. 1 (1760) 143.
Columba vernans LINNÆUS, Mantissa Plantarum (1777) 526.

Osmotreron vernans BONAPARTE, Compt. Rend. 39 (1854) 874.
Dendrophassa vernans nesophasma OBERHOLSER, Journ. Wash. Acad. Sci. 14 (1924) 297.
Treron vernans vernans HARTERT and GOODSON, Nov. Zool. 25 (1918) 355.

Basilan, Bantayan, Bohol, Calamianes, Cebu, Guimaras, Luzon, Masbate, Mindanao, Mindoro, Negros, Palawan, Panay, Siasi, Sibay, and Siquijor.

Specimens from Bantayan, Basilan, Bohol, Bongao, Jintotolo, Luzon, Mindoro, Negros, Palawan, Siasi, and Siquijor were examined.

Measurements of Dendrophassa vernans vernans based on 24 males and 13 females.

	Extremes. mm.	Mean. mm.
Wing	145–154	148.63
Tail	92–104	97.27
Culmen	15– 17	15.91
Tarsus	21– 22	21.85
Middle toe and claw	28– 31	29.61

In this study no specimen from Mindanao has been examined, thus the validity of the race described by Oberholser from that island cannot be confirmed. It may be noted, however, that Hachisuka (1932) who, I am certain, had an opportunity to study specimens from Mindanao that are in the collection of the British Museum made *Dendrophassa vernans nesophasma* Oberholser a mere synonym of *T. vernans vernans*. It is interesting to note here that specimens from Basilan that were examined in this study do not differ at all from those of the other parts of the Archipelago. This fact strengthens the findings of Hachisuka that the birds of this species in the Philippines belong to only one race.

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NEW OR LITTLE-KNOWN TIPULIDÆ FROM EASTERN ASIA (DIPTERA), XXX[1]

By Charles P. Alexander

Of Amherst, Massachusetts

THREE PLATES

The materials considered in the present report are chiefly derived from the following sources: China, collected in Hopei Province, northern China, by Mr. Chi Ho, and sent to me for study by my long-time friend, Dr. Chi Ping; a further series of interesting species from Mount Omei, secured by the Rev. Mr. George M. Franck. Japan, collected by Messrs. Esaki, Imanishi, Okada, Tokunaga, and Yamamoto. Eastern Siberia, based on very interesting collections submitted by the Russian Academy of Sciences, through the interest of Dr. Theodore Pleske and Dr. A. von Stackelberg. A few scattered specimens from diverse sources are acknowledged in the text. The types resulting from the Ho collections are deposited in the Fan Memorial Institute of Biology, Peiping; those from eastern Siberia in the collection of the Russian Academy of Sciences, Leningrad. Except where stated to the contrary, all further types are preserved in my personal series of these flies. I express my deep thanks to all of the above-mentioned entomologists for this continued friendly interest in submitting for study these neglected flies.

I am taking this opportunity to describe a new species of *Ptychoptera* from Sumatra, collected by Mrs. M. E. Walsh.

PTYCHOPTERIDÆ

PTYCHOPTERA SUMATRENSIS sp. nov. Plate 1, fig. 1.

General coloration of head and thorax blue-black; rostrum and front reddish yellow; cephalic third of postnotal mediotergite opalescent yellow; thoracic pleura yellow, the anepisternum and sternopleurite abruptly black; halteres black, the base of stem yellow; wings grayish yellow, the costal portion brighter yellow; two narrow dark brown crossbands; abdominal tergites annulated black and yellow.

[1] Contribution from the entomological laboratory, Massachusetts State College.

Male.—Length, about 8.5 millimeters; wing, 7.5.

Female.—Length, about 10 to 11 millimeters; wing, 7.7 to 8.2.

Rostrum reddish yellow; palpi with basal segment yellow, the outer segments brownish black. Antennæ with scape and pedicel yellow, flagellum black (antennæ of male broken). Front and anterior vertex reddish, the posterior portions of head blue-black.

Pronotum and propleura honey yellow. Mesonotum with scutum and scutellum uniformly blue-black, the præscutal interspaces more uniformly black; mediotergite opalescent yellow across the basal one-third to two-fifths, the posterior portion blackened; pleurotergite polished black. Pleura honey yellow, including the dorsopleural membrane; anepisternum and sternopleurite abruptly blackened. Halteres black, the base of stem narrowly yellow. Legs with the coxæ and trochanters yellow; femora yellow, the tips narrowly but conspicuously blackened; tibiæ obscure brownish yellow, the tips very narrowly darkened; tarsi black, the basitarsi paler, especially the posterior pair. Wings (Plate 1, fig. 1) tinged with pale grayish yellow, the prearcular and costal fields brighter yellow; two narrow, nearly continuous, dark brown crossbands, the first at cord, extending from R to the bend of vein Cu_1; second band extending from stigma across the forks of the outer veins, continuous or nearly so; wing tip insensibly darkened. Macrotrichia of outer cells abundant, extending basad in center of cell R before the cord (trichia indicated in figure by stippled dots). Venation: Rs short to very short; basal section of R_5 present or lacking.

Abdominal tergites annulated black and yellow, the bases of the segments beyond the second yellow, the apices broadly black, increasing in amount outwardly, the subterminal segments almost uniformly blackened; second tergite blackened at either end, yellow on central portion; basal tergite black, yellow at extreme base; sternites and genital segments of both sexes orange-yellow.

Habitat.—Sumatra (south).

Holotype, male, Pagar Alam, Palembang, altitude 2,250 feet, May 23, 1935 (*Walsh*). Allotopotype, female. Paratopotypes, 2 females.

The nearest described relatives of the present fly are *Ptychoptera annandalei* Brunetti (Burma) and *P. formosensis* Alexander (Formosa), both of which have the scutellum reddish yellow and the pleura pale yellow, unmarked. The hypopygial details are quite distinct in all three species. I have

recorded [2] an undetermined species of *Ptychoptera* as occurring in western Sumatra. The present record marks the most southeasterly distribution of the family yet made known.

TIPULIDÆ

TIPULINÆ

CTENOPHORARIA

Members of the subtribe Ctenophoraria are abundantly represented in eastern Asia, a few of the species (*Pselliophora*) occurring east of Wallace's Line in Wallacea. I am providing a key to the genera but have been obliged at this time to use only male characters. Females of several of the groups are very similar in their general appearance and no adequate characters seem to be available to distinguish such critical species. It seems very probable that *Dictenidia*, *Ctenophora*, and *Pselliophora*, at least, will eventually be reduced to subgeneric rank under the oldest name, *Ctenophora* Meigen.

Cnemoncosis Enderlein [3] can scarcely be maintained even as a subgeneric name as distinct from *Ctenophora*. The name is based on a species, *nohirai* Matsumura (as *hilgendorfi* Enderlein), that shows in both sexes a conspicuous dilation of the posterior tibiæ. It may be noted that the nearest ally, *Ctenophora yezoana* Matsumura, does not show this dilation, and it is evident that in the case where it occurs it is a specific feature only. Moreover, there are still other species of *Ctenophora* (as *C. pilosa* Pierre and *C. tricolor* Loew) that show a comparable expansion of the posterior femora, but these undoubtedly are congeneric with *Ctenophora* and no special name has been required for their reception.

Key to the Ctenophoraria of eastern Asia.

GENERA (MALE SEX ONLY)

1. Flagellar segments with obtusely rounded lobes, the longest not three times the diameter of the segment ..... 2.
   Flagellar segments beyond the first with distinct branches that are several times as long as the diameter of the segment..... 3.
2. Flagellar segments 3 to 13 each with two obtuse semiovate lobes, the more basal one slightly larger, about two and one-half times the diameter of the segment, the outer lobe a little shorter.
   Plocimas Enderlein.
   Flagellar segments 3 to 12 each with a single obtuse lobe.
   Prionota van der Wulp.

[2] Supplementa Entomologica 15 (1927) 90.
[3] Zool. Anzeig. 52 (1921) 219–220.

3. Flagellar segments each with two branches, one basal, one subapical, the former with setæ at tip; wings (except in *inæquipectinata*) with sparse macrotrichia in outer cells ..... *Dictenidia* Brulle.
   Flagellar segments each with three or four branches; wings without macrotrichia in cells ..... 4.
4. Flagellar segments each with three branches, the basal pair with scattered elongate setæ, the outer unpaired lobule shorter and without major setæ ..... *Tanyptera* Latreille.
   Flagellar segments with four branches, a basal and an outer pair ..... 5.
5. Flagellar branches unequal, the outer pair shorter than the basal ones. *Ctenophora* Meigen.
   Flagellar branches equal in length or virtually so ..... 6.
6. Flagellar branches short; first flagellar segment with two short branches, one basal, the other subapical, the latter deeply bifid. *Malpighia* Enderlein.
   Flagellar branches long and slender, abundantly clothed with delicate erect setulæ; first flagellar segment with a single lobe that is pointed at apex ..... *Pselliophora* Osten Sacken.

MALPIGHIA VITTATA (Meigen).

Ctenophora vittata MEIGEN, Syst. Beschreib. 6 (1830) 285.
Ctenophora amœna LOEW, Beschreib. Europ. Dipteren 2 (1871) 22–24; 3 (1873) 3 (in part).
Malpighia vittata ENDERLEIN, Zool. Jahrb., Syst. 32 (1912) 19–21, figs. C, D.

This species appears to be very wide-spread over the entire northern Palæarctic Region. The degree of variation in the structure of the male antennæ and hypopygium seems to permit the recognition of but a single valid species throughout this vast area. Moreover, it is very questionable whether *Malpighia angustipennis* (Loew), of western North America, can possibly be maintained as being more than a geographic race. The validity of *M. portschinskyi* Enderlein, described from a figure made many years ago by Portschinsky, is very questionable, and presumably can be settled only by examination of Portschinsky's type, if such still exists. Regarding the synonymy of *amœna* (Loew), as indicated above, the type specimen is a composite, the head being from a *Tanyptera atrata* (Linnæus) and glued to the body of a male *Malpighia vittata*.

The species, as it occurs in eastern Asia, may be briefly redescribed:

Antennal scape and pedicel black in both sexes. In the male the simple basal lobe of the first flagellar segment is usually bright orange, the bifid outer lobe brownish black, similar to the other flagellar branches. In the female only nine distinct antennal segments, the seventh flagellar being pointed at tip and evidently the product of fusion of five segments, its total

length less than the combined seventh and eighth antennal segments. Enderlein [4] figures the female antennæ as having thirteen distinct segments, but this condition certainly does not obtain in any material that I have seen. The flagellum of the female is orange throughout. Head and mesothorax black, variegated only by the bright yellow dorsopleural membrane and the orange pronotal scutellum. Abdominal tergites with the broad black median stripe of female continuous and of nearly equal width throughout, but in some specimens with the dorsum of the outer three or four tergites black, interrupted by yellow caudal rings; lateral tergal darkenings distinct or greatly reduced, in cases virtually lacking.

Numerous records are available from eastern Siberia and northern China, but to this date I have no record of the genus or species from Japan.

Golden Horn, Vladivostok, June 4, 1911 (*Rydzewski and Kusnetzov*); Vinogradovka, Ussuri, June 13, 1929 (*Djakonov and Filippjev*); Jakovlevka, Spassk district, June 3, 1926 (*Djakonov and Filippjev*); Maiche region, near Shkotovo, Ussuri, June 4, 1927 (*Stackelberg*); Okeanoskaja, near Vladivostok, June 25, 1926 (*Mordvilko*); Uval, Ussuri, May 12, 1913 (*Jemeljanov*); Amur River, near Kolvo, June 22 to 25, 1911 (*Soldatov*); near Permskaje, Habarovsk, June 3, 1911 (*Soldatov*); material in the Russian Academy of Sciences.

Eastern Tombs, Hopei Province, northern China, altitude 4,875 feet, June 7, 1931 (*C. Ho*); Fan Memorial Institute of Biology.

DICTENIDIA BIMACULATA (Linnæus).

Tipula bimaculata LINNÆUS, Fauna Suec. ed. 2 (1761) 433; Syst. Naturæ ed. 12 (1767) 972.

Okeanoskaja station, near Vladivostok, July 22 and August 7 to 12, 1911 (*Schavinskaya*); Russian Academy of Sciences.

I had earlier [5] recorded this European species from Kamchatka.

DICTENIDIA LUTEICOSTALIS Alexander.

Dictenidia luteicostalis ALEXANDER, Philip. Journ. Sci. 59 (1936) 228.

The type was from Szechwan, western China. A second female, Eastern Tombs, Hopei Province, northern China, altitude 4,875 feet, July 17, 1930 (*Ho*).

[4] Zool. Jahrb., Syst. 32 (1912) 19, fig. D.
[5] Arkiv för Zoologi 19 A, No. 9 (1927) 6.

This second specimen is a little larger than the type, the posterior leg being correspondingly conspicuous. The black pattern of the mesonotum is somewhat different from the type, there being three entire præscutal stripes and conspicuous blackened areas on the scutal lobes.

DICTENIDIA PICTIPENNIS PICTIPENNIS Portschinsky.

Ctenophora pictipennis PORTSCHINSKY, Horæ Soc. Ent. Rossicæ 21 (1887) 3–4, pl. 1, fig. 1.

Dictenidia fasciata semifasciata ALEXANDER, Ann. & Mag. Nat. Hist. IX 15 (1925) 392.

The type of *pictipennis* was from Vladivostok; that of *semifasciata* from various stations in Hokkaido, northern Japan. There is no doubt that the name *pictipennis* must replace *fasciata* Coquillett for the commonest species of the genus in eastern Asia; the latter name may be retained for the form or subspecies having the broad basal dark fascia completely traversing the wing without change in color.

The two forms seem to intergrade almost insensibly. A female from Iwate, Japan (July, 1916, *Nohira*) has cells Cu, 1st A, and 2d A pale. The type material of *semifasciata* has the dark color of the basal fascia restricted to cells C to R, inclusive. The Chinese specimen recorded below has this dark pattern still different, restricted to cells R and M, cells C and Sc being uniformly pale.

As now known, typical *pictipennis* has a range including northern Japan, eastern Siberia, and northern China.

Sedanka, near Vladivostok, August 10, 1913 (*Berger*); Habarovsk, Ussuri, July 28, 1927 (*Stackelberg*). Eastern Tombs, Hopei Province, northern China, altitude 4,875 feet, July 17, 1930 (*Ho*).

CTENOPHORA YEZOANA Matsumura.

Ctenophora yezoana MATSUMURA, Thousand Insects of Japan 2 (1906) 124, pl. 29, fig. 6.

Cnemoncosis uniplagiata ALEXANDER, Ann. Ent. Soc. America 17 (1924) 442.

Matsumura's original description of *yezoana* is entirely in Japanese. The type material of *uniplagiata* differs markedly from the description of *yezoana*, especially in the pattern of the thorax, and it seems evident that the sclerites of the thoracic dorsum were much confused by Matsumura. The color pattern, as shown by the types of *uniplagiata*, varies somewhat in dif-

ferent individuals but always within restricted limits that may be described as follows:

Anterior border of præscutum uniformly blackened, the yellow referred to by Matsumura evidently pertaining to the broad central yellow area of the pronotal scutellum; three distinct black or brownish black præscutal stripes, in cases with the laterals joined to the median by a dark cloud on the anterior interspace; yellow ground color of præscutum restricted to the humeral triangle and the interspaces; scutum black, usually including the median area, the broad posterior borders of the scutal lobes yellow; scutellum entirely black; mediotergite black, each anterolateral angle broadly yellow. Pleura black, the dorsopleural membrane broadly light yellow.

Antennal scape and pedicel black dorsally, paler beneath; flagellum (female) light yellowish brown. Frontal prolongation of head and front yellow, narrowly lined medially with black; genæ protuberant, yellow. Second abdominal tergite yellow, the outer third blackened, sending a median dark line to anterior border; posterior yellow margins of succeeding segments entire or broken by a median black prolongation.

CTENOPHORA YEZOANA NIGROBASALIS subsp. nov. Plate 1, fig. 2.

Male.—Length, about 20 millimeters; wing, 15.

Female.—Length, about 20 to 25 millimeters; wing, 13 to 17.

Characters as in typical *yezoana* Matsumura, differing as follows:

Antennæ (male) black, the entire lower surface of scape yellow; in female, antennal flagellum entirely black. Surface of thorax entirely dull, not at all polished as in most species of the genus. Thoracic pleura conspicuously variegated by yellow, including major areas on the ventral pleurotergite, almost the entire pteropleurite and the dorsal sternopleurite. Fore and, in cases, middle coxæ yellow or reddish, posterior coxæ black, pruinose; posterior tibiæ black, with a broad whitish ring at and beyond midlength; in typical *yezoana* the entire basal half of this tibia is chiefly pale. Wing venation as shown (Plate 1, fig. 2). Abdominal tergites yellow, with a median black line that expands at the posterior border; basal rings of tergites narrowly blackened, the color continued caudad along the lateral border of the tergite almost to the posterior margin, inclosing sublateral areas of the ground color; eighth and ninth segments (male) uniformly black; basal sternites almost uniformly yellow, the outer seg-

ments progressively more darkened medially. In the female the yellow intersegmental membrane shows on the dorsum as transverse annuli between the tergites.

Habitat.—Eastern Siberia (Ussuri).

Holotype, male, Jakovlevka, Spassk district, June 17, 1926 (*Djakonov and Filippjev*). Allotopotype, female, July 2, 1926. Paratype, female, Golden Horn, Vladivostok, May 29, 1911 (*Rydzevski and Kusnetzov*).

The essential distinctions lie in the black antennal flagellum of female, the variegated thoracic pleura, the blackened bases of the posterior tibiæ, and the abdominal pattern.

CTENOPHORA BIGUTTATA Matsumura.

Ctenophora biguttata MATSUMURA, Thousand Insects of Japan, Add. 2 (1916) 454–455, pl. 24, fig. 16.

This fly, described from northern Japan, is now known from several stations in eastern Siberia, recorded below. The species varies very notably in the pattern of the mesonotal præscutum, in many cases, including the type, there being three entire black stripes, in other individuals with the lateral stripes partly or entirely obliterated. The brownish black to black subterminal ring of the posterior femur is conspicuous and usually entire, but in some cases obliterated on the ventral surface of the sclerite.

Jakovlevka, Spassk district, Ussuri, June 17, 1926 (*Djakonov and Filippjev*); June 25, 1927 (*Martynov*); Tigrowaja, Suchan district, June 16, 1927 (*Stackelberg*); 20 kilometers east of Spasskoje, May 11 to June 24, 1910 (*Skonninov*). All of these specimens are females.

CTENOPHORA FEMUR-RUBRA sp. nov. Plate 1, fig. 3.

Closely related to *Ctenophora biguttata* Matsumura, differing especially in certain features of coloration.

Female.—Length, 20 to 24 millimeters; wing, 17 to 18.

Frontal prolongation of head reddish throughout or (type) blackened on sides.

Mesonotal præscutum reddish, with a single median black stripe, narrowed behind and not or scarcely reaching the suture; posterior sclerites of notum uniformly reddish, with the exception of a posterior darkening on the mediotergite. In *biguttata* there are usually three distinct præscutal stripes, the centers of the scutal lobes are blackened, the scutellum is uniformly black, and the dark area on mediotergite is more extensive. Pleura reddish, the dorsopleural membrane bright yellow; anepister-

num and sternopleurite black. Legs with all coxæ, trochanters, and femora reddish, the posterior femora less swollen near tips than in *biguttata* and without the conspicuous black subterminal darkening of the latter; posterior tibiæ orange-yellow on basal half, the posterior half clearer yellow; in *biguttata*, yellowish at base, with a broad blackish ring near midlength; posterior tarsi entirely pale. Wings (Plate 1, fig. 3) with the pattern much as in *biguttata*, the anterior half darkened, the posterior cells paler; in the paratype the posterior cells are darker, not contrasting markedly with the remainder of wing. Abdomen with outer tergites more variegated laterally with yellow.

Habitat.—Saghalien; northern China.

Holotype, Manui, Saghalien, August 3, 1922 (*Esaki*).

Paratype, female, Eastern Tombs, Hopei Province, northern China, altitude 4,875 feet, June 9, 1931 (*Ho*).

I have recorded [6] the above-mentioned Saghalien material as being *Ctenophora biguttata* Matsumura. A third closely related species is *C. parva* Portschinsky (Ussuri), which differs especially in the smaller size and almost uniformly blackened head and thorax. It is possible that these three supposed species may be found to represent forms or races of a single highly variable species.

PSELLIOPHORA BIFASCIIPENNIS Brunetti.

Pselliophora bifasciipennis BRUNETTI, Rec. Indian Mus. 6 (1911) 241–242.

Pselliophora sackeni EDWARDS, Ann. & Mag. Nat. Hist. VIII 18 (1916) 257.

Dictenidia Horikawæ MATSUMURA, Thousand Insects of Japan, Add. 2 (1916) 449–450.

Pselliophora compta ENDERLEIN, Zool. Anzeig. 52 (1921) 220–221.

A male specimen, Harbin, Manchoukuo, July 1, 1909 (*Vassiljev*), in the Russian Academy of Sciences, provides the most northern known record for this genus and species.

In body coloration this specimen might well be taken to represent a distinct species, but the wing pattern and structure of the male hypopygium indicate that it pertains to this highly variable species. Head and thorax uniformly orange, without dark markings. Abdomen orange, the tergites with a narrow median dark vitta; hypopygium dark brown, the tergal lobes passing into black.

Scarcely anything is known concerning the degree of color variation in this genus. The allied *Ctenophora apicata* Osten

[6] Philip. Journ. Sci. 24 (1924) 596.

Sacken (Nearctic) has been shown to be highly polymorphic, the body coloration ranging from black to reddish yellow.[7]

TANYPTERA JOZANA UNILINEATA subsp. nov.

General coloration of mesonotum reddish, the præscutum with a single, median, polished, black stripe; antennæ (male) with flagellar segments chiefly yellow, the tips of the branches dusky; wings strongly suffused with yellow, stigma black or brownish black; abdomen, including the hypopygium, reddish, the tergites with a nearly continuous median black stripe.

Male.—Length, about 20 millimeters; wing, 15 to 17.

Female.—Length, 25 to 28 millimeters; wing, 15 to 18.

Male.—Antennæ with the scape black; pedicel and flagellum chiefly yellow, the outer ends of the branches dusky, more evident on the outer segments. Head black.

Mesonotal præscutum deep reddish, with a single median black stripe, narrowed behind and reaching the suture; posterior sclerites of mesonotum reddish, the caudal margin of mediotergite blackened; in cases (Vladivostok specimen) with the scutellum black. Pleura reddish, variegated with darker areas, the ground color more or less restricted to beneath the wing root; dorsopleural membrane yellow. Halteres yellow. Legs yellow, the outer tarsal segments black; in cases (Vladivostok specimen) with femoral tips narrowly blackened. Wings strongly suffused with yellow; stigma black or brownish black.

Abdomen reddish, the color including the hypopygium; tergites with a narrow, nearly continuous, black, median stripe, the areas a little expanded behind on the individual segments; hypopygium relatively large.

Female.—Abdomen with basal two segments reddish, the remainder black, or reddish with a black median line on tergites, the caudal borders of the segments yellow.

Habitat.—Eastern Siberia; northern China.

Holotype, male, Kamen-Rybolov, Lake Chanka, Ussuri, Siberia, May 22, 1908 (*Djukin*). Allotype, female, Reinovo, Dshalinda, Amur, July 1 to 3, 1915 (*Popoff*). Paratypes, male, Golden Horn, Vladivostok, May 28, 1911 (*Rydzewski and Kusnetzov*); male, Ulunga, Amur Province, June 3, 1910 (*Mishin*); female, Eastern Tombs, Hopei Province, northern China, altitude 4,875 feet, July 14, 1930 (*Ho*).

The reddish mesonotum, with a single median black stripe, distinguishes the present fly from typical *jozana* (Matsumura).

[7] Johannsen, O. A., Maine Agr. Exp. Sta. Bull. 177 (1910) 32–35.

TIPULARIA

TIPULA (TIPULODINA) HOPEIENSIS sp. nov. Plate 1, fig. 4; Plate 2, figs. 25 and 26.

General coloration gray, the præscutum with three brown stripes; pleura uniformly light yellow; antennæ (male) short, if bent backward not attaining the wing root; posterior tibia with two white rings; all tarsi with outer three segments darkened; wings weakly infumed, clearer white before and beyond cord; a restricted darker brown pattern at wing tip; male hypopygium with the eighth sternite only moderately sheathing; appendage of basistyle straight, with a blackened spine near tip.

Male.—Length, about 15 millimeters; wing, 14.5.

Frontal prolongation of head brown; nasus distinct; palpi brownish black, the terminal segment of moderate length only, paling to yellow. Antennæ short, if bent backward not attaining the wing root; scape and pedicel light yellow, flagellum black; flagellar segments subcylindrical, the basal enlargement very insignificant; verticils chiefly unilateral in distribution, shorter than the segments. Front light silvery gray; posterior part of head darker brownish gray, with very vague suggestions of a median darker vitta.

Pronotum brownish gray medially, yellow on sides. Mesonotal præscutum light gray, with three brown stripes, the median one divided on anterior half by a capillary darker vitta; scutum dark gray, each lobe with two brown areas; scutellum blackish, the parascutella a little paler; mediotergite brownish gray; pleurotergite yellow, the dorsal portion more grayish. Pleura, including the dorsopleural region, light yellow. Halteres brownish yellow, the knobs infuscated. Legs with the coxæ and trochanters yellow; all femora yellow, the tips narrowly but conspicuously blackened; fore tibia black, the basal fifth a trifle brightened; a relatively narrow snowy white ring before the subequal black apex; midtibia similar, the white ring a trifle more extensive than the apex; posterior tibia with two white rings, the subbasal one less clearly white than the subapical, the latter about one-third more extensive than the dark apex; basitarsi black on proximal portions; second tarsal segment dirty white, more or less darkened at either end; outer three tarsal segments darkened; legs long and slender. Wings (Plate 1, fig. 4) with the ground color weakly infumed, clearer white before and beyond the cord; cell Sc and stigma dark brown; wing tip in cells R_2 to R_5, inclusive, paler brown; cord narrowly seamed with brown, interrupted at fork of M; veins brown, paler

in the whitish areas. Venation: Rs a little shorter than R_{2+3}; second section of vein M_{1+2} arcuated, narrowing the base of cell R_5; petiole of cell M_1 shorter than m; basal section of M_3 shorter than m; cell 2d A very narrow, striplike.

Abdominal tergites brownish black, the basal three segments more brownish on sides; hypopygium black; styli and hypopygial appendages yellow. Male hypopygium (Plate 2, fig. 25) with the tergite, 9*t*, separated from the sternite by membrane; basistyle, *b*, relatively large, fused with the sternite except on ventral portion, the caudal margin obtusely rounded; appendage of basistyle as figured (Plate 2, fig. 26). Ninth tergite (Plate 2, fig. 25, 9*t*) transverse, the caudal-lateral angles rounded, the median region produced slightly caudad and bearing a small tuft of black setæ at lateral portions; viewed from beneath, these lateral portions are produced ventrad into flattened sclerotized plates. Outer dististyle (Plate 2, fig. 26, *od*) slender, entirely pale. Inner dististyle (Plate 2, fig. 26, *id*) of complicated structure, as figured; a highly compressed pale blade, with a powerful posterior blackened arm. Eighth sternite, 8*s*, relatively short and only moderately sheathing the ninth, the apex obtuse and provided with a sparse fringe of short setæ; distal portion of sternite thinner and paler than basal portion.

Habitat.—China (Hopei).

Holotype, male, Eastern Tombs, altitude 4,875 feet, July 13, 1930 (*Ho*); Fan Memorial Institute No. 2730.

The closest relative is *Tipula* (*Tipulodina*) *nipponica* (Alexander), of Kiushiu, Japan, which differs in the larger size, gray pleura and coxæ, white outer tarsal segments, and wider cell 2d A. I have never seen a male of this latter species. The present record indicates the most northern distribution for any member of the subgenus (40° north latitude).

TIPULA (YAMATOTIPULA) PARVINCISA Alexander.

Tipula (*Tipula*) *parvincisa* ALEXANDER, Philip. Journ. Sci. 52 (1933) 311–312.

The types were from the Ussuri district, eastern Siberia, as far south as Vladivostok.

Males and females, Peiping, Hopei, China, June 18, 1930 (*Ho*).

TIPULA (OREOMYZA) PINGI sp. nov. Plate 1, fig. 5; Plate 2, fig. 27.

General coloration gray, the præscutum with four entire darker brownish gray stripes; antennæ with basal three segments yellow, the remainder black; head with a capillary brown median vitta on vertex; wings with borders chiefly darkened,

the disk and bases of anal cells whitened; outer half of cell R_5 white; abdominal tergites obscure yellow, trivittate with brownish black, the fifth and succeeding segments uniformly darkened; male hypopygium with the tergite bearing an acute median point; outer dististyle broadly spatulate.

Male.—Length, about 13 millimeters; wing, 14.

Female.—Length, about 20 millimeters; wing, 16.5.

Frontal prolongation of head light brown, moderately elongate, nasus conspicuous; palpi black. Antennæ (male) relatively short, if bent backward not attaining the wing root; basal three segments yellow, the remainder black; basal enlargements of the segments only feebly indicated; longest verticils subequal to the segments; terminal segment reduced to a small oval structure. Head light gray, the front and anterior vertex more whitish; a very delicate capillary brown vitta from the vertical tubercle to the occiput; posterior genæ suffused with dusky.

Mesonotal præscutum gray, with four darker brownish gray stripes that are unbordered with darker and not well-defined against the ground; intermediate stripes strongly narrowed behind; posterior sclerites of notum gray, without distinct markings. Pleura pale gray, the dorsopleural membrane light yellow. Halteres yellow, the knobs dark brown. Legs with the coxæ pruinose; trochanters yellow; femora yellow, the tips narrowly but conspicuously blackened; tibiæ yellowish brown, the tips narrowly darkened; tarsi brownish black; tibial spur formula 1–2–2; claws (male) with long basal tooth. Wings (Plate 1, fig. 5) with the borders chiefly darkened, the center of disk and bases of anal cells white; prearcular field and cells C and Sc uniformly darkened, the latter a little more intense; a conspicuous white poststigmal band, beginning at costa, ending in bases of cells M_3 and M_4, more or less confluent across the cord with the major pale area in cell M; distal half of cell R_5 conspicuously pale; pale areas before and beyond origin of Rs in cell R; pale area in cell M divided at near midlength by a narrow, oblique, brown vitta, the outer pale subarea a little larger; cell Cu chiefly pale on more than basal half, the distal portion darkened; cell Cu_1 and seam on m-cu narrowly dark brown; veins pale yellow in the whitish areas, darker in the brown markings. Venation: Rs nearly twice as long as m-cu; R_{1+2} entirely preserved; m-cu on M_4 just beyond base.

Abdominal tergites obscure yellow, trivittate with brownish black, on the fifth and succeeding segments becoming more uniformly blackened. Male hypopygium (Plate 2, fig. 27) with the

tergite, 9*t*, entirely separated from the sternite; basistyle completely separated, its outer portion not produced caudad. Ninth tergite, 9*t*, with a median dorsal depression that is further produced caudad into an acute compressed point that does not extend beyond level of the blackened, obtuse, sublateral lobes; dorsum of tergite with scattered setæ, except in the median depression. Outer dististyle, *od*, very narrow at base, the distal two-thirds dilated into a spatula. Inner dististyle, *id*, as figured; basal portion on outer margin more blackened. Gonapophyses, *g*, appearing as flattened black blades, each terminating in a ventrally directed spine, the caudal margin with a series of smaller spines. Eighth sternite, 8*s*, unarmed.

Habitat.—China (Hopei).

Holotype, male, Eastern Tombs, altitude 4,875 feet, July 17, 1930 (*Ho*). Allotopotype, female, in author's collection.

I take great pleasure in naming this handsome species in honor of Dr. Chi Ping, my long-time friend and colleague. The species is quite distinct from other somewhat similar species, as *Tipula* (*Oreomyza*) *famula* Alexander, *T.* (*O.*) *futilis* Alexander, and *T.* (*O.*) *vitiosa* Alexander. Of the above, only the last has the outer portion of cell R_5 white, as in the present fly, and in all other regards is a very different species.

TIPULA (OREOMYZA) PLATYGLOSSA sp. nov. Plate 1, fig. 6; Plate 2, fig. 28.

Belongs to the *juncea* group; mesonotum chiefly dark gray; antennæ (male) long, the flagellar segments binodose; wings hyaline, the costal border and stigma pale brownish yellow; R_{1+2} entire; male hypopygium with the tergite deeply notched medially, the lateral lobes truncated and blackened at tips; outer dististyle unusually long and slender; eighth sternite with a broad shovel-shaped lobe.

Male.—Length, about 18 millimeters; wing, 17.

Frontal prolongation of head relatively short; nasus short but distinct; palpi with basal segment obscure brownish yellow, the remainder black. Antennæ with scape and pedicel yellow, flagellum black; antennæ broken at near midlength, when entire apparently about one-half as long as wing; flagellar segments elongate, incised to appear weakly binodose, the basal enlargement shorter but a little deeper than the apical portion; verticils much shorter than the segments. Front and anterior part of vertex yellow, posterior portions of head dark gray.

Mesonotal præscutum deformed in type, apparently almost uniformly blackish gray; scutal lobes similarly darkened; scutellum and central portion of mediotergite darkened, the parascutella, lateral portions of mediotergite, and the pleurotergite yellow. Pleura yellow, variegated with darker on ventral portions. Halteres elongate, pale, the knobs weakly darkened. Legs with the coxæ brownish yellow; trochanters yellow; femora brownish yellow, the bases clearer, the tips narrowly brownish black; tibiæ and tarsi passing into brownish black; vestiture of bases of femora very short and delicate. Wings (Plate 1, fig. 6) hyaline, cells C, Sc, Cu_1, and the stigma pale brownish yellow; veins brown. Macrotrichia relatively numerous on veins beyond cord; squama naked. Venation: Rs about one-half longer than m-cu; R_{1+2} entire; M_{3+4} short, subequal to basal section of M_{1+2}; cell M_4 of nearly equal width at base and apex; m-cu just beyond origin of M_4.

Abdomen with tergites chiefly yellow, weakly variegated with darker; sternites yellow. Male hypopygium (Plate 2, fig. 28) with the tergite, 9*t*, separated from the sternite, 9*s*, by membrane; basistyle not clearly differentiated from sternite, its caudal-dorsal angle produced caudad and slightly dorsad into a subacute sclerotized projection; caudal-ventral portion of basistyle with a small setiferous arcuate lobe, directed mesad. Ninth tergite, 9*t*, with a deep V-shaped notch, the lateral lobes truncated and blackened at tips; on ventral face, on outer margin back from tip, a small blackened point, most evident when viewed from the side. Outer dististyle long and slender, as in the group; basal third slightly dilated on cephalic face. Inner dististyle, *id*, with the beak unusually slender; base of style produced into a flattened leaflike blade, the disk of which bears a few scattered setæ. Eighth sternite, 8*s*, bearing a broad, liguliform lobe, its apex truncated; along either lateral border with a dense brush of delicate setæ, these longer and covering the entire surface at and near apex of lobe.

Habitat.—Siberia.

Holotype, male, Tunkun, Sajan (in author's collection through Staudinger and Bang-Haas).

From the other regional members of the *juncea* group, as *juncea* Meigen and *mystica* Alexander, the present fly differs especially in the hyaline wings, with distinct venational details, and minor differences in the structure of the male hypopygium.

TIPULA (LUNATIPULA) VALIDICORNIS Alexander.

Tipula (*Lunatipula*) *validicornis* ALEXANDER, Philip. Journ. Sci. 52 (1933) 322–324.

Described from eastern Siberia. Specimens from the Eastern Tombs, Hopei Province, northern China, altitude 4,875 feet, July 6, 1930 (male), July 5, 1930 (female) (*Ho*).

TIPULA HOI sp. nov. Plate 1, fig. 7.

General coloration of body polished ferruginous-yellow; præscutum with a very conspicuous black median stripe; legs yellow, long and slender; wings hyaline, the prearcular region, cells C and Sc, and the stigma conspicuously pale yellow; Rs much shorter than m-cu; ovipositor with cerci long and slender, straight.

Female.—Length, about 25 millimeters; wing, 20.

Frontal prolongation of head polished yellow; nasus distinct; palpi with basal two segments yellow, the terminal segments infuscated. Antennæ yellow, the outer flagellar segments a little more brownish yellow; scape elongate, slightly exceeding the first flagellar segment; flagellar segments with basal enlargements poorly to scarcely developed; longest verticils on outer face, each segment with additional elongate setæ at and near midlength of the segment on outer face; terminal segment long-oval, a little exceeding one-third the length of the penultimate. Head polished yellow.

Pronotum yellow. Mesonotal præscutum polished ferruginous-yellow, with a single, conspicuous, median, black stripe, narrowed behind and nearly attaining the suture; this stripe feebly divided on anterior half by a pale line; lateral stripes polished yellow, entirely concolorous with the interspaces but without short yellow setæ, as in the case of the latter; pseudosutural foveæ inevident; posterior sclerites of notum entirely polished ferruginous-yellow. Pleura polished ferruginous-yellow, entirely glabrous. Halteres yellow, the knobs weakly darkened. Legs long and slender, yellow, only the terminal two tarsal segments darkened; tibial spur formula 1–1–2. Wings (Plate 1, fig. 7) hyaline, the prearcular field, costal and subcostal cells, and the stigma conspicuously yellow, the two latter elements clearer but paler yellow; veins pale brown. Macrotrichia present on veins R_{2+3}, R_2, base of R_{1+2}, R_3, R_{4+5}, M_1, and M_2; lacking on Rs and remainder of medial field; squama naked. Venation: Sc_2 ending just beyond midlength of Rs, the latter short, subequal to R_{2+3} and much shorter than m-cu; R_{1+2} short, diverging strongly from R_3, its basal portion more thickened

and provided with trichia; petiole of cell M_1 only about one-third m; M_{3+4} subequal to basal section of M_3; m-cu at fork of M_{3+4}; cell M_4 wide at base; cell 2d A wide.

Abdomen polished ferruginous, without clearly defined darker marking. Ovipositor with cerci long and slender, straight, much exceeding the compressed hypovalvæ.

Habitat.—China (Hopei).

Holotype, female, Eastern Tombs, altitude about 4,875 feet, July 17, 1930 (*Ho*).

I take great pleasure in naming this fly in honor of Mr. Chi Ho, of the Fan Memorial Institute of Biology. *Tipula hoi* is a singularly beautiful species that bears a great resemblance to a large species of *Nephrotoma* but is unquestionably a species of *Tipula*. There is no described ally in eastern Asia, though somewhat similar forms occur in western North America. Without the male sex, I am unwilling to hazard an opinion as to the subgeneric position of the fly.

LIMONIINÆ

LIMONIINI

ORIMARGA (ORIMARGA) STREPTOCERCA sp. nov. Plate 1, fig. 8; Plate 2, fig. 29.

General coloration of thorax light gray; rostrum, palpi, and antennæ black; femora and tibiæ obscure yellow, the tips narrowly and conspicuously dark brown; wings pale yellow, the veins pale; R_{2+3} nearly as long as Rs; R_{1+2} and R_2 subequal; m-cu usually far basad, before level of origin of Rs; abdomen, including hypopygium, black; male hypopygium with the gonapophyses complex, the outer branch very strongly curved.

Male.—Length, about 6.5 millimeters; wing, 5.5.

Female.—Length, about 8 millimeters; wing, 7.

Rostrum and palpi black. Antennæ black throughout. Head light gray.

Mesonotum light gray, with three barely indicated præscutal stripes. Pleura almost uniformly light gray. Halteres pale throughout. Legs with the coxæ and trochanters whitish yellow; femora obscure yellow, the tips rather narrowly but conspicuously dark brown; tibiæ obscure yellow, the tips very narrowly dark brown; tarsi passing into dark brown. Wings (Plate 1, fig. 8) uniformly pale yellow, with pale veins. Costal fringe of moderate length; macrotrichia of veins beyond cord relatively numerous and well distributed, including a complete series of about 16 on vein R_3; about 25 on almost the entire length of the distal section of vein R_{4+5}; and about 15 on each

of veins M_{1+2} and M_3, restricted to the distal two-thirds of the veins. Venation: Sc_1 ending nearly opposite two-thirds the length of Rs, Sc_2 near its tip; R_2 and R_{1+2} subequal; R_{2+3} nearly as long as Rs; basal section of R_{4+5} strongly arcuated before midlength; M_{3+4} about two-thirds as long as M_4 alone; m-cu lying far basad before the level of origin of Rs; cell 2d A relatively long and wide.

Abdomen, including hypopygium, black. Male hypopygium (Plate 2, fig. 29) with the basistyle, *b*, unarmed, but with a heavy grouping of setæ on mesal face at base. Outer dististyle, *od*, slender, gently sinuous to the acute apex. Inner dististyle, *id*, subequal in length, with numerous setæ. Gonapophyses, *g*, complex, the outer branch very strongly curved, the distal free end a flattened blade with the tip acute.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, Chu Lao Tong Temple, altitude 6,000 to 7,000 feet, July 27, 1935 (*Franck*). Allotopotype, female.

By my key to the Chinese species of *Orimarga*[8] the present fly runs to *Orimarga* (*Orimarga*) *omeina* Alexander, which seems to be its nearest ally. The species is readily told by the pattern of the legs, the pale yellow wings with pale veins, and especially by the peculiar structure of the gonapophyses of the male hypopygium.

DICRANOPTYCHA CÆSIA PALLIDIBASIS Alexander.

Dicranoptycha cæsia pallidibasis ALEXANDER, Philip. Journ. Sci. 44 (1931) 353–354.

Described from the Japanese Alps, Shinano, Honshiu, Japan.

Two specimens, Eastern Tombs, Hopei, northern China, altitude 4,875 feet, July 6 to 10, 1930 (*Ho*).

PEDICIINI

DICRANOTA (RHAPHIDOLABIS) ANGULATA sp. nov. Plate 1, fig. 9.

Size large (wing, female, 7.5 millimeters); general coloration of thorax gray, the præscutum with three darker plumbeous-gray stripes, the posterior interspaces, scutellum, and cephalic portion of the mediotergite pale; halteres pale throughout; femora obscure yellow basally, the tips infuscated, broadly so on forelegs; wings yellowish subhyaline, the stigma merely indicated; veins pale yellowish brown; R_{2+3+4} present; Rs strongly arcuated to feebly angulated at near midlength.

Female.—Length, about 6 millimeters; wing, 7.5.

[8] Philip. Journ. Sci. 54 (1934) 327.

Rostrum and palpi brownish black. Antennæ with scape and pedicel black; flagellum broken. Head uniformly gray.

Pronotum and mesonotum gray, the præscutum with three darker plumbeous-gray stripes, the lateral pair narrow, the broad median vitta nearly reaching the suture; posterior interspaces passing into light brown; scutal lobes darkened; scutellum pale testaceous-brown, more yellowish behind; mediotergite with cephalic fourth yellowish, the remainder blackened, pruinose. Pleura chiefly light gray, the dorsal portion and the ventral sternopleurite darker brown. Halteres pale throughout. Legs with the coxæ and trochanters obscure yellow; femora obscure yellow basally, the tips infuscated, more extensively so on the forelegs where only about the proximal fourth is brightened; tibiæ pale brown, the tips narrowly darker; tarsi brownish black. Wings (Plate 1, fig. 9) yellowish subhyaline, the stigma merely indicated against the ground; veins pale yellowish brown. Venation: R_2 erect, subequal to or longer than R_{1+2}; R_{2+3+4} preserved, exceeding the basal section of R_5; Rs strongly arcuated to feebly angulated at near midlength.

Abdomen dark brown, sparsely pruinose. Ovipositor with the powerful upcurved cerci yellow.

Habitat.—Japan (Honshiu).

Holotype, female, Iwate-gun, Iwate-ken, altitude 3,000 feet, June 9, 1935 (*Yamamoto*).

The nearest described ally is *Dicranota* (*Rhaphidolabis*) *subconsors* Alexander, which differs most evidently in the smaller size, different thoracic coloration, and details of venation, especially of the radial field.

DICRANOTA (AMALOPINA) NEBULIPENNIS sp. nov. Plate 1, fig. 10; Plate 2, fig. 30.

General coloration pale yellowish white, including the palpi, antennæ, and legs; wings whitish hyaline, heavily variegated with brown and gray spots and clouds, including a major area occupying the outer radial field and large clouds at ends of veins Cu_1 and 2d A; abdomen pale yellow, the subterminal segments brown; male hypopygium with the interbasal structures flattened, their outer ends expanded and broadly obtuse.

Male.—Length, about 5.5 millimeters; wing, 6.5.

Rostrum, palpi, and antennæ entirely pale yellow, the latter relatively short. Head yellow.

Prothorax and mesothorax uniformly yellowish white. Halteres pale yellow throughout. Legs pale yellow, the outer tarsal segments dark brown. Wings (Plate 1, fig. 10) with the

ground color whitish hyaline, heavily spotted and marbled with pale brown and gray; cell C chiefly pale; crossveins and deflections with dark seams; a series of gray spots along vein Cu; outer radial and medial field chiefly covered by a large, irregular, darkened area extending across the outer radial field from R_{1+2} to the fork of M_{1+2}; large darkened clouds at ends of veins Cu_1 and 2d A; veins pale, darker in the clouded areas. Venation: A supernumerary crossvein in cell R_1; cell 1st M_2 closed; both sections of M_{3+4} subequal.

Abdomen pale yellow, the subterminal segments brown; hypopygium more yellowish brown. Male hypopygium (Plate 2, fig. 30) with the tip of basistyle, *b*, beset with abundant acute spines. Dististyle, *d*, simple, narrowed to outer end, which bears spinous setæ of various lengths. Interbase, *i*, a flattened rod, the distal portion broadly obtuse. Lateral tergal spine, 9*t*, long and slender, the tip acute.

Habitat.—Japan (Honshiu).

Holotype, male, Iwate-gun, Iwate-ken, altitude 3,000 feet, May 17, 1935 (*Yamamoto*).

The heavily spotted wings suggest *Dicranota* (*Amalopina*) *siberica* Alexander, but in the present fly the pattern is unusually heavy, especially in the outer radial field.

HEXATOMINI

Genus ADELPHOMYIA Bergroth

Adelphomyia BERGROTH, Mittheil. Naturf. Ges. Bern für 1890 (1891) 134.

Oxydiscus DE MEIJERE, Tijd. voor Ent. 56 (1913) 350.

Subgenus PARADELPHOMYIA novum

Characters as in *Adelphomyia*, differing especially in the presence of a supernumerary crossvein in cell R_3 at near two-thirds the length (Plate 1, fig. 11).

Type of subgenus.—*Adelphomyia* (*Paradelphomyia*) *crossospila* sp. nov. (Eastern Palæarctic Region: Western China.)

The relationship of the present group to *Adelphomyia* is exactly comparable to that existing between *Dicranophragma* Osten Sacken and *Limnophila* Macquart.

ADELPHOMYIA (PARADELPHOMYIA) CROSSOSPILA sp. nov. Plate 1, fig. 11; Plate 2, fig. 31.

General coloration black, the sublateral portions of præscutum brighter; antennæ black, the basal flagellar segment pale; halteres and legs yellow; wings cream-colored, with a heavy brown

pattern, including a series of marginal spots; cell 1st M_2 elongate; anal veins strongly incurved to margin; male hypopygium with the outer dististyle terminating in three major spines; inner dististyle very broad, especially near base.

Male.—Length, about 3.5 millimeters; wing, 4.2.

Rostrum and palpi black. Antennæ black, 16-segmented; first flagellar segment whitish; flagellar segments elongate, the verticils exceeding the segments in length. Head brownish black.

Pronotum black. Mesonotal præscutum black, the region of the usual lateral stripes occupied by more brownish areas; posterior sclerites of mesonotum black. Pleura black. Halteres relatively elongate, whitish throughout. Legs with the fore and middle coxæ darkened; the posterior coxæ paler; trochanters obscure yellow; remainder of legs pale yellow, only the terminal tarsal segments darkened; tibial spurs present. Wings (Plate 1, fig. 11) cream-colored, the prearcular and costal regions clearer yellow; a conspicuous brown pattern, distributed as follows: Arculus; origin of Rs; stigma; tip of vein R_{1+2}; along cord and outer end of cell 1st M_2; supernumerary crossveins in cell R_3; a series of large areas at ends of all longitudinal veins, smallest on R_5, thence becoming progressively larger to the last anal vein; axillary margin infumed; veins pale, darkened in the infuscated areas. Coarse and sparse macrotrichia in cells R_2 to M_4, inclusive (indicated in figure by stippled dots). Venation: Sc_1 ending just before fork of Rs; R_2 a little shorter than R_{2+3}; a supernumerary crossvein in cell R_3; cell 1st M_2 very long, the second section of vein M_{1+2} exceeding any of the veins issuing from the cell; m about one-half the basal section of M_3; m-cu at near midlength of vein M_{3+4}; anal veins strongly curved into wing margin.

Abdomen, including hypopygium, black, the segments with long erect setæ. Male hypopygium (Plate 2, fig. 31) with the outer dististyle, *od*, armed at tip with three major spines, the two outermost curved. Inner dististyle, *id*, very broad, the surface set with numerous setæ and setulæ. Basistyle, *b*, obtuse at apex, not produced into a spinous apical point, as in certain other eastern Asiatic species of the genus, including *ariana* Alexander and *nipponensis* Alexander, but not *latissima* Alexander.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, Chu Lao Tong Temple, altitude 6,000 to 7,000 feet, at light, July 27, 1935 (*Franck*).

This interesting *Adelphomyia* requires no comparison with any previously described member of the genus, since the subgeneric character of a supernumerary crossvein in cell R_3 of the wings is not possessed by any other species. The most generally similar form in the typical subgenus is *Adelphomyia* (*Adelphomyia*) *nebulosa* (de Meijere).

LIMNOPHILA (PHYLIDOREA) YAMAMOTOI sp. nov. Plate 1, fig. 12.

General coloration of entire body polished black; antennal flagellum and legs yellow; wings amber yellow, the basal and costal fields clearer yellow; outer veins brownish black, conspicuous; m-cu just before midlength of cell 1st M_2.

Female.—Length, about 10 millimeters; wing, 9.5.

Rostrum and palpi black. Antennæ with scape black; pedicel brownish yellow; flagellum pale yellow; flagellar segments elongate, with verticils that exceed the segments. Head black, sparsely pruinose, especially on anterior vertex.

Entire thorax polished black, only the membrane surrounding the wing root a little paler. Halteres pale yellow. Legs entirely pale yellow, excepting only the terminal three tarsal segments, which are darkened. Wings (Plate 1, fig. 12) chiefly clear amber yellow, the prearcular and costal regions a trifle clearer yellow; stigma not differentiated; veins in the prearcular and costal fields clearer yellow, the outer veins brownish black, conspicuous against the ground, these darkened elements including also veins M, Cu, 1st A, and 2d A. Venation: Sc_1 ending opposite the fork of Rs, Sc_2 longer, extending shortly beyond this fork; Rs relatively long, angulated at origin; veins R_{2+3} and R_5 approximated, cell R_3 widened beyond R_2; m-cu just before midlength of cell 1st M_2.

Abdomen entirely polished black, with long, erect, whitish setæ. Ovipositor with the genital shield and bases of cerci, as well as all of hypovalvæ, black, the tips of cerci paler.

Habitat.—Japan (Honshiu).

Holotype, female, Iwate-gun, Iwate-ken, altitude 3,000 feet, June 28, 1935 (*Yamamoto*).

This very distinct *Limnophila* is named in honor of the collector, Mr. Hiromu Yamamoto, to whom I am indebted for many Tipulidæ from northern Honshiu. The species is readily told from all other members of the subgenus by the uniformly polished black body, in conjunction with the entirely yellow legs and antennal flagellum.

LIMNOPHILA (IDIOPTERA) USSURIANA IWATENSIS subsp. nov.

Differs from the typical form (eastern Siberia) in various details.

Antennæ (female) black throughout; antennæ of male broken. Mesonotum uniformly black, sparsely pruinose, but without evident stripes. Pleura more conspicuously pruinose. Fore femora black, only the proximal fifth yellow; middle femora with about the basal third yellow; posterior femora with about the basal two-thirds yellow, gradually passing into black. Venation and wing pattern much as in the typical form. Abdomen black in both sexes, the hypopygium somewhat brightened. Male hypopygium with the terminal spine of the outer dististyle central in position and unusually small, the outer apical region of the style being expanded and glabrous. In typical *ussuriana* the spine is larger and arises from the outer apical portion of the style.

Habitat.—Japan (Honshiu).

Holotype, male, Iwate-gun, Iwate-ken, altitude 3,000 feet, June 21, 1935 (*Yamamoto*). Allotopotype, female, June 28, 1935.

It seems very probable to me that the present fly will deserve full specific rank when perfect specimens of the male become available. The subgenus *Idioptera* had not been recorded from the Japanese Empire.

ERIOPTERINI

CHIONEA GRACILISTYLA sp. nov. Plate 2, fig. 32.

Size small (length, male, 3.5 to 4.5 millimeters); legs moderately incrassated, the vestiture delicate; general coloration brown, the hypopygium and preceding segment blackened; antennæ 6-segmented, there being three flagellar segments beyond the fusion segment, the terminal segment small; male hypopygium with the outer lobe of dististyle preserved as a small bilobed blackened structure; inner lobe of dististyle slender, with a group of erect spines at and near apex, and with a conspicuous basal tubercle on mesal face; phallosome with both pairs of gonapophyses obtuse, not projecting caudad beyond level of ædeagus.

Male.—Length, about 3.5 to 4.5 millimeters.

General coloration (in alcohol) brown, the hypopygium and preceding segment brownish black to black; antennæ dark brown throughout. Legs yellowish brown.

Antennæ 6-segmented, there being three flagellar segments beyond the fusion; terminal segment a little less than one-half the penultimate. Legs, including the posterior pair, only moderately incrassated, more strongly so in the Amur paratypes; vestiture of legs consisting of long, erect, silken setæ. Male hypopygium (Plate 2, fig. 32) having the general structure of *C. nipponica,* there being a small, blackened, more or less bidentate, basal lobe or distinct style, *d,* at base of the long inner lobe, the latter relatively long and slender, with a triangular lobe or tooth on base of mesal face; distal end of style set with numerous microscopic spines. Phallosome, *p,* much as in *nipponica,* the gonapophyses incurved and not projecting caudad beyond the distal end of the ædeagus; lateral apophyses with delicate setulæ scattered over surface. In the Amur paratype, the lateral apophyses are broader and more truncated at their tips, the longer inner apophyses with the tips more slender and less expanded than in the Japanese type.

Habitat.—Japan; eastern Siberia.

Holotype, male on microscope slide, Chiosen, Honshiu, Japan (*Imanishi*); additional material from this same source in Kyoto Imperial University collection. Paratype, male, Tukuringa Mountains, Amur Province, eastern Siberia, November 1, 1915 (*Koshantschikov*), in the Russian Academy of Sciences.

The present fly is much smaller than *Chionea nipponica* Alexander, the only species hitherto described from eastern Asia, differing moreover in the marked reduction in the number of antennal segments, there being only six, instead of nine or ten. The nearest relative in the western Palæarctic fauna is *C. crassipes* Boheman, which has 7-segmented antennæ, dark, incrassated legs, and is of somewhat larger size. The antennæ of the holotype of the present insect are shriveled and possibly may not conform exactly to the description given above which is based primarily on the paratype. The western Nearctic *C. alexandriana* Garrett likewise has 6-segmented antennæ, but in all other regards is a very different fly.

GONOMYIA (LIPOPHLEPS) FUNESTA sp. nov. Plate 1, fig. 13.

Belongs to the *abbreviata* group; antennæ black throughout; pronotum and anterior lateral pretergites obscure yellow; mesonotum gray, the præscutum obscure yellowish gray; pleura almost uniformly reddish gray, the anepisternum and ventral sternopleurite a trifle darker; legs brownish black to black; wings with a strong brownish gray tinge, the prearcular field

yellow; cell 1st M_2 closed; abdominal tergites and sternites brownish black.

Female.—Length, about 4.8 millimeters; wing, 5.

Rostrum and palpi dark. Antennæ black throughout; segments passing through oval and long-oval to subcylindrical; longest verticils a trifle longer than the segments. Head dark-colored, the front and anterior vertex paler.

Pronotum and anterior lateral pretergites obscure yellow. Mesonotal præscutum and scutum dark brownish gray, the pseudosutural foveæ blackened; scutellum obscure yellowish gray; mediotergite gray. Pleura almost uniformly reddish gray, the anepisternum and ventral sternopleurite a trifle darker. Halteres obscure yellow, the knobs a little more obscure. Legs with the coxæ and trochanters obscure testaceous; remainder of legs brownish black or black. Wings (Plate 1, fig. 13) with a strong brownish gray tinge, the prearcular field and costal border more yellowish; stigmal region vaguely darkened, occupying most of cell R_1; veins brown, luteous at wing base. Venation: Sc short, with Sc_2 at tip of Sc_1; distance along vein R between Sc_2 and origin of Rs subequal to petiole of cell R_3; Rs short, arcuated to weakly angulated at origin; R_3 unusually erect, subequal to the distance on margin between veins R_{1+2} and R_3; cell 1st M_2 closed; m-cu shortly beyond fork of M.

Abdominal tergites and sternites brownish black, the genital segments only a little brightened; valves of ovipositor dark horn-colored.

Habitat.—China (Szechwan).

Holotype, female, Mount Omei, Chu Lao Tong Temple, altitude 6,000 to 7,000 feet, at light, July 27, 1935 (*Franck*).

Allied to *Gonomyia* (*Lipophleps*) *gracilistylus* Alexander (Japan) and *G.* (*L.*) *prædita* Alexander (Formosa), differing chiefly in various colorational details, as the grayish mesonotum, darker thoracic pleura, uniformly darkened abdomen, and black legs. Unfortunately the male sex is still unknown.

GONOMYIA (GONOMYIA) JUSTIFICA sp. nov. Plate 1, fig. 14; Plate 2, fig. 33.

Belongs to the *subcinerea* group; antennæ black throughout; scutellum bright yellow; pleura yellow, variegated on anepisternum and ventral sternopleurite by reddish brown; legs black; wings with a strong brown tinge, the prearcular and costal portions a little more yellowish; vein R_{2+3+4} strongly arched; male hypopygium with both the inner dististyle and the ædeagus bearing a single, blackened, spinous point.

Male.—Length, about 3.5 millimeters; wing, 4.2.

Rostrum obscure yellow; palpi black. Antennæ black throughout; flagellar segments long-oval to elongate; longest verticils exceeding the segments. Head gray.

Pronotum and anterior lateral pretergites light sulphur yellow. Mesonotal præscutum dark brownish gray, the humeral region obscure yellow; scutal lobes similarly dark brownish gray, the median area broadly obscure yellow; scutellum bright yellow; mediotergite brownish gray, the cephalic lateral angle more yellowish. Pleura yellow, variegated by reddish brown on the anepisternum and ventral sternopleurite; dorsopleural region yellow. Halteres yellow, the knobs weakly darkened. Legs with the coxæ reddish brown; trochanters obscure yellow; remainder of legs black. Wings (Plate 1, fig. 14) with a strong brown tinge, the prearcular and costal portions a little more yellowish; stigma vaguely darkened; veins brown, more luteous in the yellow areas. Venation: Sc_1 ending shortly beyond origin of Rs, the distance slightly variable, in the type being immediately opposite this origin; R_{2+3+4} strongly arched; m-cu slightly variable in position, from close to, to about one-third its own length beyond, the fork of M.

Abdominal tergites brown, the sternites yellow; hypopygium yellow. Male hypopygium (Plate 2, fig. 33) with the basistyle, *b*, produced apically into a short lobe. Outer dististyle, *od*, a long pale cylindrical lobe, provided with scattered setæ, including a group of longer ones at apex. Inner dististyle, *id*, triangular in outline, terminating in a single, powerful, horn-like spine. Phallosome, *p*, with a single blackened spine, arising near base.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, Chu Lao Tong Temple, altitude 6,000 to 7,000 feet, at light, July 27, 1935 (*Franck*). Paratopotype, male.

The nearest regional ally of the present fly is *Gonomyia* (*Gonomyia*) *omeiensis* Alexander, which differs especially in the details of wing venation and structure of the male hypopygium, notably of both dististyles.

ERIOPTERA (ERIOPTERA) HOLOXANTHA sp. nov. Plate 1, fig. 15; Plate 3, fig. 34.

Size large (wing, male, over 6 millimeters); general coloration yellow, including the antennæ, halteres, and legs; wings strongly suffused with yellow, the veins darker yellow; male hypopygium with the outer dististyle short-stemmed, the outer half expanded into a triangular head, its distal margin thickened and more or less bifid on outer cephalic angle; inner dististyle

long and slender, gently curved, narrowed to the acute decurved apex, on outer face at near three-fourths the length with a low blackened tooth.

Male.—Length, about 5.5 to 6 millimeters; wing, 6.5 to 6.8.

Rostrum yellow; palpi pale brown. Antennæ pale yellow, the outer segments a trifle darker; flagellar segments oval, the outer ones more attenuated. Head uniformly light yellow.

Pronotum yellow. Anterior lateral pretergites pale sulphur yellow. Mesonotal præscutum yellow, with three more reddish brown stripes that are but little conspicuous against the ground; humeral region brighter yellow; posterior sclerites of mesonotum yellow. Pleura pale yellow. Halteres pale yellow throughout. Legs yellow, only the outer tarsal segments a trifle darkened. Wings (Plate 1, fig. 15) with a strong, uniform yellow suffusion, the veins deeper yellow; outer costal fringe a little darkened. Venation: Vein 2d A rather strongly sinuous on distal third.

Abdomen, including hypopygium, yellow, the gonapophyses and distal end of outer dististyle blackened. Male hypopygium (Plate 3, fig. 34) with the outer dististyle, *od,* short-stemmed, the outer half expanded into a triangular head, its distal margin thickened and more or less bifid on outer cephalic angle, the surface unroughened. Inner dististyle, *id,* long and slender, gently curved, narrowed to the acute decurved apex; on outer face at near three-fourths the length with a low, obtuse, blackened tooth. Gonapophyses, *g,* appearing as slender, straight rods, the margins smooth, the distal half of each intensely blackened.

Habitat.—Japan (Honshiu).

Holotype, male, Iwate-gun, Iwate-ken, altitude, 3,000 feet, July, 7, 1935 (*Yamamoto*). Paratopotypes, 7 males.

In its general appearance the present fly is most similar to such species as *Erioptera* (*Erioptera*) *flavescens* (Linnæus), *E.* (*E.*) *flavohumeralis* Alexander, and *E.* (*E.*) *xanthoptera* Alexander, differing from all in the larger size, the yellow body coloration, and especially the hypopygial structure.

ERIOPTERA (EMPEDA) NIGROSTYLATA sp. nov. Plate 1, fig. 16; Plate 3, fig. 35.

General coloration gray; halteres light yellow throughout; legs dark brown, the femora with abundant appressed flattened scales, in addition to the usual setæ; wings grayish subhyaline, the prearcular and costal regions slightly more yellow; Sc_1 ending about opposite midlength of Rs; veins R_3 and R_4 both relatively long and lying generally parallel to one another; male hypopygium with the outer dististyle entirely blackened, bifid, with both arms glabrous.

Male.—Length, 3.5 to 4 millimeters; wing, 3.5 to 4.

Female.—Length, about 4 millimeters; wing, 4.

Rostrum, palpi, and antennæ black. Head light gray.

Anterior lateral pretergites light yellow. Mesonotal præscutum gray laterally, more brownish gray medially; posterior sclerites of mesonotum light gray. Pleura gray. Halteres clear light yellow throughout. Legs with the coxæ and trochanters yellow; remainder of legs dark brown; femora with appressed flattened scales interspersed with the setæ. Wings (Plate 1, fig. 16) grayish subhyaline, the prearcular and costal region slightly more yellow; veins brown, more luteous in the yellow regions. Venation: Sc relatively long, Sc_1 ending near midlength of Rs; veins R_3 and R_4 both relatively long and lying generally parallel to one another; m-cu at fork of M.

Abdomen dark brown, the hypopygium yellow. Male hypopygium (Plate 3, fig. 35) with the outer dististyle entirely blackened, both arms smooth, the outer slender and more or less parallel-sided; inner arm much expanded at distal end. Inner dististyle, *id*, appearing as a pale compressed blade.

Habitat.—China (Szechwan).

Holotype male, Mount Omei, Chu Lao Tong Temple, altitude 6,000 to 7,000 feet, at light, July 27, 1935 (*Franck*). Allotopotype, female. Paratopotypes, males and females.

The present fly is quite distinct from the other species of *Empeda* so far described from Palæarctic Eastern Asia in the long Sc, appressed scales on femora, and structure of the outer dististyle of the male hypopygium. It is apparently most nearly related to *Erioptera* (*Empeda*) *sulfureoclavata* Alexander, which has the styli of the male hypopygium entirely pale.

ORMOSIA NIGRIPENNIS sp. nov. Plate 1, fig. 17; Plate 3, fig. 36.

Belongs to the *nigripila* group; general coloration black, the præscutum and scutum rich reddish brown; antennal flagellum obscure yellow; legs (male) with femora black, tibiæ abruptly yellow; legs (female) black, the extreme bases of tibiæ yellow; wings with a strong blackish tinge, the stigmal area a trifle darker; cell 1st M_2 closed, small; anal veins divergent; male hypopygium with the gonapophyses appearing as flattened blades, the tips simple, acute.

Male.—Length, about 4.2 to 4.4 millimeters; wing, 5.

Female.—Length, about 5 to 5.5 millimeters; wing, 5.2 to 5.8.

Rostrum and palpi black. Antennæ with scape and pedicel dark, flagellum obscure yellow; flagellar segments short-cylin-

drical, with verticils that exceed the segments in length. Head dark.

Pronotum black. Anterior lateral pretergites restrictedly obscure yellow. Mesonotal præscutum and scutum rich reddish brown, the anterior portion of the former a little darkened; scutellum brown; mediotergite black. Pleura black. Halteres yellow, with light yellow setæ. Legs with the coxæ black; trochanters brighter; in male with femora black, the tibiæ abruptly yellow, the tarsi passing into brown; in female, legs entirely black, excepting the yellow extreme bases of tibiæ. Wings (Plate 1, fig. 17) with a strong blackish tinge throughout, the stigmal field only a trifle darker; veins a little darker than the ground. Macrotrichia dark, well distributed over the wing surface, lacking in the bases of the cells on both sides of arculus (shown by stippled dots in figure). Venation: Sc_1 ending opposite R_2, Sc_2 about opposite one-third the length of Rs; R_2 subequal to R_{2+3}, oblique; cell 1st M_2 closed, small, as in the group; m-cu sinuous, at fork of M; anal veins divergent.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 36) as in the group. Ninth tergite deeply concave caudally. Inner dististyle, *id*, with five powerful subequal setæ. Gonapophyses, *g*, appearing as strong flattened blades, the long-extended tips acute, simple. Ovipositor with cerci horn yellow, hypovalvæ black.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, White Cloud Temple, altitude 9,000 feet, at light, July 29, 1935 (*Franck*). Allotopotype, female, summit, altitude 11,000 feet, July 30, 1935. Paratopotypes, 3 males; paratypes, 1 female, with allotype.

The nearest described ally is *Ormosia diversipes* Alexander (Japan), which differs especially in the larger size, darkened mesonotum, paler, more grayish brown wings, with slightly different venational details, and the male hypopygium, especially the deeply bifid gonapophyses. The striking difference in the coloration of the legs of the two sexes of the present fly is exactly paralleled in *O. diversipes*, and the name *O. atripes* Alexander, based on the female sex of this species, must be placed in the synonymy. It is strange that none of the numerous Nearctic species of the *nigripila* group shows this sexual dimorphism.

ORMOSIA TENUISPINOSA sp. nov. Plate 1, fig. 18; Plate 3, fig. 37.

Belongs to the *similis* group; general coloration dark gray; antennæ (male) elongate, exceeding one-half the length of body;

halteres yellow; legs black; wings obscure yellow, patterned with darker, including cell C, stigmal area, seams along cord and outer fork of M, and a narrow apical darkening; anal veins convergent; abdomen, including hypopygium, black; male hypopygium with the ninth tergite broad, its caudal margin gently concave; outer gonapophyses of unusual length and slenderness, trispinous.

Male.—Length, about 5 millimeters; wing, 5.5; antenna, about 2.8.

Rostrum gray; palpi black. Antennæ black throughout, of unusual length when compared with other regional species, if bent backward extending to shortly beyond the base of abdomen; basal flagellar segment unusually long and apparently formed by the fusion of two normal segments; succeeding segments elongate, the outer ones becoming more nearly cylindrical; segments with individual elongate secund verticils and a shorter dense erect pale pubescence. Head dark gray.

Pronotum dark gray. Anterior lateral pretergites obscure. Mesonotum and pleura almost uniformly dark gray, the præscutum a trifle more brownish gray, not at all brightened; pseudosutural foveæ and tuberculate pits black. Halteres golden yellow. Legs with the coxæ gray; trochanters brownish yellow; remainder of legs black. Wings (Plate 1, fig. 18) with the ground color obscure yellowish brown, rather conspicuously patterned with darker; cell C chiefly infuscated; stigmal area and seams along cord, together with outer fork of M darkened; apical border of wing narrowly and inconspicuously darkened, not appearing as dark spots at ends of veins; prearcular field restrictedly yellow; veins pale in the ground areas, darker in the infuscated portions. Macrotrichia of cells abundant (indicated in figure by stippled dots). Venation: R_2 more than twice R_{2+4}; m-cu at fork of M; anal veins sinuous, convergent.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 37) with the tergite, 9*t*, broad, duplicated beneath, the outer margin gently concave; isolated patches of setæ in pale membrane before outer end of tergite. Inner dististyle, *id*, narrow, more or less triangular in outline. Gonapophyses entirely blackened, the outer pair, *og*, very conspicuous, slender, the longer axial spine strongly decurved; inner apophysis, *ig*, bidentate at apex.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, summit, altitude 11,000 feet, at light, July 30, 1935 (*Franck*).

The combination of elongate antennæ and structure of the male hypopygium readily separates the present fly from any of the other regional species. I am using the term *similis* group for numerous species in the Holarctic Region that have the outer dististyle of the hypopygium more or less flattened-clavate, the outer surface clothed with parallel rows of closely appressed spines or spinous setæ.

ORMOSIA FIXA sp. nov. Plate 1, fig. 19; Plate 3, fig. 38.

Belongs to the *similis* group; general coloration, including præscutum, dark gray; antennæ short, black throughout; halteres light yellow; legs black; wings weakly suffused with brownish, cell C and the stigma darker; anal veins convergent; abdomen, including hypopygium, black; male hypopygium with the outer gonapophyses profoundly divided, the outer arm stouter, bearing a small lateral spine before apex; inner dististyle a horn-colored flattened blade, the apex acute, the outer margin with conspicuous setæ.

Male.—Length, about 4 millimeters; wing, 4.5.

Rostrum and palpi black. Antennæ black throughout, short, if bent backward extending about halfway to the wing root; flagellar segments oval, the longest verticils unilaterally distributed and approximately two or more times as long as the segment; flagellar segments gradually decreasing in length outwardly. Head dark gray.

Mesothorax almost uniformly dark gray, the præscutum with the pseudosutural foveæ and tuberculate pits black. Halteres with base of stem dusky, the remainder light yellow. Legs with the coxæ dark gray; trochanters brownish black; remainder of legs black. Wings (Plate 1, fig. 19) weakly suffused with brownish, cell C darker; stigmal region infumed; a scarcely indicated brown tinge along cord; veins dark brown. Macrotrichia numerous (indicated in figure by stippled dots). Venation: Sc_2 about opposite midlength of Rs; R_2 close to fork of R_{2+3+4}, R_{2+3} being thus obliterated or virtually so; union of distal section of vein M_3 and m angulated; m-cu close to fork of M; anal veins convergent.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 38) with the ninth tergite, 9*t*, having the apex entire, gently convex. Inner dististyle moderately broad, the apex bearing the usual fasciculate bristle hyaline. Outer gonapophyses, *og*, black, profoundly divided, the inner arm a long slender rod, the apex obtuse; outer arm much stouter, from an

expanded base, before apex bearing a small lateral spine. Inner gonapophyses, *ig*, appearing as curved flattened blades, horn-colored, the apex of each acute; outer margin with conspicuous setæ.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, summit, altitude 11,000 feet, at light, July 30, 1935 (*Franck*).

The present species is quite distinct from other black-legged regional species in the group in the short black antennæ and the somewhat peculiar structure of the male hypopygium, notably of the gonapophyses.

ORMOSIA PROFESTA sp. nov. Plate 1, fig. 20; Plate 3, fig. 39.

Belongs to the *similis* group; antennæ and legs black; mesothorax dark gray; legs black; wings rich buff-yellow, conspicuously variegated by dark spots and seams, including a marginal series on all longitudinal veins; abdomen black; male hypopygium with the outer gonapophyses appearing as flattened plates, the outer angle produced into a strong spine, the remainder of the apophysis terminating in from six to ten smaller teeth.

Male.—Length, about 5 millimeters; wing, 6.

Rostrum and palpi black. Antennæ black throughout, of moderate length. Head dark gray.

Pronotal scutellum obscure yellow. Mesonotum dark gray, without distinct markings, the humeral areas of the præscutum a trifle brighter; pseudosutural foveæ and tuberculate pits black. Pleura gray. Halteres light yellow throughout. Legs with the coxæ brownish gray; trochanters obscure yellow; remainder of legs black. Wings (Plate 1, fig. 20) rich buff-yellow, with a conspicuous brown pattern, including areas at origin of Rs; Sc_2; tip of Sc_1, the latter confluent with a band across cord; a cloud at outer fork of M; marginal spots at ends of all longitudinal veins, somewhat larger and more conspicuous in the radial field; cell C slightly more infumed than cell Sc; stigmal area, between the dark spots at tips of veins Sc_1 and R_{1+2}, more saturated yellow; veins and macrotrichia yellow, darker in the infuscated areas. Macrotrichia unusually abundant, including cell Cu, lacking only in the basal portions of cell Sc (shown in figure by stippled dots). Venation: Sc_1 ending opposite R_2; veins R_3 and R_4 slightly upcurved at tips; cell 1st M_2 open; union of m and distal section of vein M_3 a gentle curve; vein 2d A sinuous.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 39) with the tergite, 9*t*, relatively narrow, the apex

slightly narrower than base, transverse, set with abundant delicate setulæ. Outer dististyle, *od,* a flattened scooplike structure, set with numerous transverse to oblique rows of spinous setæ, as in group. Inner dististyle, *id,* produced outwardly into a narrow point that bears a single strong fasciculate seta. Gonapophyses of powerful structure; outer pair, *og,* darkened, expanded distally, the apex with numerous spinous points, including a strong outer spine; the number of lesser apical points ranges from six to ten on the two sides of the type, so is evidently a highly variable character; at base of apophysis a slender smooth rod. Inner gonapophysis, *ig,* a little shorter than the outer, darkened, at apex produced into two flattened flaplike lobes, their tips acute.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, White Cloud Temple, altitude 9,000 feet, at light, July 29, 1935 (*Franck*).

The only other species from this general region having somewhat similarly patterned wings is *Ormosia auricosta* Alexander, which differs in the yellow legs, with narrow subterminal darkened ring on femora, and in the strongly suffused wings with much brighter costal border.

ORMOSIA OFFICIOSA sp. nov. Plate 1, fig. 21; Plate 3, fig. 40.

Belongs to the *nimbipennis* group; general coloration of thorax black, the præscutum and scutum reddish brown; antennæ (male) of moderate length, dark throughout; male hypopygium with a single well-developed dististyle, appearing as a curved hook, the apical fifth blackened; gonapophyses appearing as blackened toothlike structures, without evident lateral denticles.

Male.—Length, about 4 millimeters; wing, 4.5; antenna, about 1.6.

Female.—Length, about 4.5 millimeters; wing, 4.8 to 5.

Rostrum and palpi black. Antennæ of moderate length, dark throughout; flagellar segments subcylindrical to long-oval. Head dark.

Mesonotal præscutum and scutum reddish brown, the scutellum, postnotum, and pleura conspicuously blackened. Halteres clear pale yellow, the stem a trifle darker. Legs with the coxæ dark; trochanters obscure yellow; femora dark brown, with dark setæ; tibiæ and tarsi a trifle brighter in color. Wings (Plate 1, fig. 21) with a very pale brown tinge, cells C and Sc a trifle darker; stigmal region infuscated; veins pale, those along the cord a little darker. Macrotrichia of cells relatively numerous

though lacking in bases of cells M to 2d A (indicated in figure by stippled dots). Venation: Sc_2 shortly before midlength of Rs; R_2 oblique, subequal to R_{2+3}; outer fork of M gently curved to subangular; m-cu close to fork of M; anal veins convergent.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 40) with the tergal plate, 9*t*, gently expanded outwardly, the caudal end feebly emarginate. A single well-developed dististyle, *d*, as in the group, appearing as a curved hook, the apical fifth blackened; on the concave side before tip with several setæ; other scattered setæ nearer base of style; a small obtuse structure at base of style presumably represents the usual second dististyle. Gonapophyses, *g*, reduced to blackened, conical, toothlike structures. Ædeagus expanded on basal two-thirds, the apical portion slender, the tip decurved.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, White Cloud Temple, altitude 9,000 feet, at light, July 29, 1935 (*Franck*). Allotopotype, female, pinned with type. Paratopotypes, males and females.

The nearest ally is the species herewith described as *Ormosia affixa* sp. nov., which differs most evidently in the longer antennæ of the male and in details of structure of the hypopygium.

ORMOSIA AFFIXA sp. nov. Plate 1, fig. 22; Plate 3, fig. 41.

Belongs to the *nimbipennis* group; general coloration of thorax dark gray, the præscutum and scutum reddish brown; antennæ (male) relatively elongate, if bent backward extending nearly to root of halteres; male hypopygium with the outer dististyle blackened, the surface with numerous setigerous punctures and tubercles; gonapophyses blackened, acute at tip, each with a sharp lateral spine on outer margin at near midlength.

Male.—Length, about 5 millimeters; wing, 5.5 to 5.8; antenna, about 2.

Rostrum and palpi black. Antennæ black, relatively elongate, as shown by the measurements; if bent backward extending nearly to root of halteres; flagellar segments long-cylindrical, with a dense, erect, white pubescence and scattered verticils. Head dark gray.

Pronotum dark brownish gray. Mesonotal præscutum and scutum reddish brown, contrasting with the dark gray scutellum, postnotum, and pleura. Halteres light yellow. Legs with the coxæ dark gray; trochanters brownish yellow; remainder of legs chiefly dark brown, the tarsi passing into black. Wings (Plate 1, fig. 22) with a faint brown tinge, the costal cell and stigma

darker; veins brown. Venation: R_2 at or close to fork of R_{3+4}, in cases beyond this fork to a distance subequal to its length; outer fork of M not or scarcely angulate; m-cu at fork of M; anal veins convergent.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 41) very similar in structure to *O. officiosa* sp. nov., but differing in several details. Dististyle, *d*, chiefly blackened, with numerous setigerous punctures and small tubercles. Gonapophyses, *g*, blackened, acute at tip, with a sharp lateral spine on outer margin at near midlength; a smaller, curved, finger-like lobule at base, presumably representing the rudimentary outer apophyses. Ædeagus less dilated on basal portion.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, summit, altitude 11,000 feet, at light, July 30, 1935 (*Franck*). Paratopotypes, 2 males.

The nearest ally is *Ormosia officiosa* sp. nov., which differs especially in the smaller size, shorter antennæ of the male, and slight but constant differences in the male hypopygium. The remaining members of the *nimbipennis* group are restricted to the eastern Nearctic Region.

DASYMOLOPHILUS JUBATUS sp. nov. Plate 1, fig. 23; Plate 3, fig. 42.

Wings broad, without macrotrichia in centers of cells; male hypopygium with the ædeagus bent at a right angle; phallosomic structure a slender pale rod, without spinous armature.

Male.—Length, about 1.8 to 2 millimeters; wing, 2.5 to 2.6.

Female.—Length, about 2.5 millimeters; wing, about 2.8.

Rostrum and palpi black. Antennæ brownish black, relatively short, if bent backward ending some distance before wing root. Head dark brown.

Thorax brownish black to dark brown, both the pronotum and mesonotum with very long erect black setæ. Halteres with base of stem pale, the remainder brownish black. Legs black throughout. Wings (Plate 1, fig. 23) grayish, with darker brownish gray veins; macrotrichia and setal fringes dark brown. Wings slightly wider than in *nokoensis;* no macrotrichia in cells, the only ones present being close to outer margin of wing. Venation: R_2 and R_{2+3} in transverse alignment and lying just basad of the basal section of R_5 and r-m.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 42) with the dististyle, *d*, unusually long and slender, the apical point a long blackened spine; subapical spine elongate, preceded by a series of four or five smaller, more dorsal

denticles. Ædeagus *a*, bent at a right angle just beyond mid-length. Phallosomic structure, *p*, a slender, pale rod that does not attain the point of angulation of the ædeagus, without spinous armature.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 6,500 feet, July 31, 1935 (*Franck*). Allotopotype, female. Paratopotypes, males.

The nearest relative is *Dasymolophilus nokoensis* Alexander, of Formosa. The various regional species may be separated by the following key:

Key to the Palæarctic species of Dasymolophilus.

MALES

1. Outer cells of wing with series of macrotrichia appearing in linear rows along the centers of certain cells, especially M_4 ..... 2.
   Cells of wing without macrotrichia, except for scattered marginal ones at extreme outer ends of cells ..... 3.
2. Phallosomic structure appearing as a slender strobiloid rod, with scattered spinose points. (Japan, Formosa.) ..... *kibunensis* sp. nov.
   Phallosomic structure large, heavily blackened, with obtuse denticles on outer face. (Europe.) ..... *murinus* (Meigen).
3. General coloration of mesonotum and pleura light brown; wings relatively narrow. (Formosa.) ..... *nokoensis* Alexander.
   General coloration of mesonotum and pleura brownish black; wings broader. (Western China.) ..... *jubatus* sp. nov.

DASYMOLOPHILUS KIBUNENSIS sp. nov. Plate 3, fig. 43.

Male.—Length, about 1.6 to 1.7 millimeters; wing, 2.4 to 2.5.

Characters as in *D. murinus* (Meigen), differing especially in the structure of the male hypopygium.

A restricted series of macrotrichia in cells of wings, most persistent as a linear row up the center of cell M_4 between m-cu and fork of M_{3+4}; in the type specimen, with such trichia in outer ends of cells R_2, R_3, R_4, R_5, M_2, and M_3. Venation: m-cu slightly variable in position, in the holotype located less than its own length before the fork of M, in other cases a little more than this length.

Male hypopygium (Plate 3, fig. 43) with the dististyle, *d*, slender, the apical point relatively short, preceded by four or five acute spines, with a partial second row of smaller spinulæ. Ædeagus, *a*, nearly straight, the distal third angularly bent. Phallosomic structure, *p*, small, subcylindrical to nearly terete, covered with microscopic spinulose points to appear somewhat strobiloid.

Habitat.—Japan, Formosa.

Holotype, male, Kibune, Kyoto, Honshiu, Japan, altitude 750 feet, at light, June 1, 1930 (*Tokunaga*); on slide. Paratopotypes, 2 males, on slide. Paratype, male, Arisan, Formosa, altitude 6,500 to 8,000 feet, July 7, 1929 (*Issiki*).

The Formosan paratype certainly appears to be conspecific with the Japanese types. The species is most nearly allied to the European *Dasymolophilus murinus* (Meigen), the interrelationships being shown in the key provided under the account of the preceding species. *Dasymolophilus murinus* has the phallosomic structure (Plate 3, fig. 44, *p*) of the male hypopygium considerably larger, more sclerotized and blackened, and of distinct construction.

MOLOPHILUS OKADAI sp. nov. Plate 1, fig. 24; Plate 3, fig. 45.

Belongs to the *gracilis* group and subgroup; general coloration of entire body intense black; antennæ short, flagellum pale brown; halteres yellow; legs yellow, the femoral tips broadly and conspicuously blackened; tibial bases narrowly, the tips more broadly, blackened; outer four tarsal segments black; wings uniformly suffused with grayish yellow, the prearcular and costal regions clearer yellow; veins yellowish brown; male hypopygium with the dorsal lobe of basistyle bifid; both dististyles simple, with microscopic spinulæ on distal portions.

Male.—Length, about 3.2 to 3.4 millimeters; wing, 4.2 to 4.5.

Female.—Length, about 4 millimeters; wing about 5.

Head and palpi black. Antennæ short in both sexes; scape and pedicel black; flagellum pale brown; flagellar segments oval, the verticils much exceeding the segments.

Thorax entirely intense black. Halteres yellow. Legs of male with the coxæ brownish black; trochanters yellow; femora light yellow, the tips broadly and conspicuously blackened, including about the distal third on fore and middle legs and about the distal fourth on the posterior legs; tibiæ yellow, the bases very narrowly, the tips somewhat more extensively blackened, the latter about equal to from one-third to one-half the femoral darkening; basitarsi yellow, the tips and remainder of tarsi brownish black. Wings (Plate 1, fig. 24) uniformly suffused with grayish yellow, the prearcular and costal portions clearer light yellow; veins yellowish brown, clearer yellow in the more luteous portions. Venation: R_2 opposite or slightly before r-m; m-cu about one-third to one-half the petiole of cell M_3; vein 2d A relatively long, extending beyond the cephalic end of m-cu.

Abdomen, including hypopygium and all appendages, intense black. Male hypopygium (Plate 3, fig. 45) with the dorsal lobe of basistyle, *db*, appearing as a double structure, the outer spine straight, narrowed to an acute point, the surface of outer half with microscopic appressed spinulæ; inner arm a glabrous curved spine; ventral lobe of basistyle, *vb*, a long clavate structure, provided with abundant, very long, recurved setæ. Outer dististyle, *od*, longer than the other appendages of the hypopygium, the basal half a trifle expanded, the outer portion gently curved and densely set with microscopic appressed spinulæ. Inner dististyle, *id*, smaller, the base expanded, the long apical spine with several small erect conical spines.

Habitat.—Japan (Hokkaido).

Holotype, male, Sapporo, Ishikari, July 2, 1935 (*Okada*). Allotopotype, female. Paratopotypes, 4 males and females.

Holotype and allotype returned to Professor Okada for inclusion in the Entomological Museum, Hokkaido Imperial University; paratypes in author's collection.

I take unusual pleasure in naming the species in honor of the collector, Prof. I. Okada. The fly is the most distinctively colored species so far discovered in eastern Asia. The coloration of the legs is very striking, somewhat similar to the condition found in the otherwise very different *Molophilus nakamurai* Alexander (Japan). In the present species the uniformly black body, in conjunction with the pale wings, is very conspicuous.

ILLUSTRATIONS

[Legend: *a*, Ædeagus; *b*, basistyle; *d*, dististyle; *db*, dorsal lobe of basistyle; *g*, gonapophysis; *id*, inner dististyle; *ig*, inner gonapophysis; *od*, outer dististyle; *og*, outer gonapophysis; *p*, phallosome; *s*, sternite; *t*, tergite; *vb*, ventral lobe of basistyle.]

Plate 1

Fig. 1. *Ptychoptera sumatrensis* sp. nov.; venation.
2. *Ctenophora yezoana nigrobasalis* subsp. nov.; venation.
3. *Ctenophora femur-rubra* sp. nov.; venation.
4. *Tipula* (*Tipulodina*) *hopeiensis* sp. nov.; venation.
5. *Tipula* (*Oreomyza*) *pingi* sp. nov.; venation.
6. *Tipula* (*Oreomyza*) *platyglossa* sp. nov.; venation.
7. *Tipula hoi* sp. nov.; venation.
8. *Orimarga* (*Orimarga*) *streptocerca* sp. nov.; venation.
9. *Dicranota* (*Rhaphidolabis*) *angulata* sp. nov.; venation.
10. *Dicranota* (*Amalopina*) *nebulipennis* sp. nov.; venation.
11. *Adelphomyia* (*Paradelphomyia*) *crossospila* sp. nov.; venation.
12. *Limnophila* (*Phylidorea*) *yamamotoi* sp. nov.; venation.
13. *Gonomyia* (*Lipophleps*) *funesta* sp. nov.; venation.
14. *Gonomyia* (*Gonomyia*) *justifica* sp. nov.; venation.
15. *Erioptera* (*Erioptera*) *holoxantha* sp. nov.; venation.
16. *Erioptera* (*Empeda*) *nigrostylata* sp. nov.; venation.
17. *Ormosia nigripennis* sp. nov.; venation.
18. *Ormosia tenuispinosa* sp. nov.; venation.
19. *Ormosia fixa* sp. nov.; venation.
20. *Ormosia profesta* sp. nov.; venation.
21. *Ormosia officiosa* sp. nov.; venation.
22. *Ormosia affixa* sp. nov.; venation.
23. *Dasymolophilus jubatus* sp. nov.; venation.
24. *Molophilus okadai* sp. nov.; venation.

Plate 2

Fig. 25. *Tipula* (*Tipulodina*) *hopeiensis* sp. nov.; male hypopygium, details.
26. *Tipula* (*Tipulodina*) *hopeiensis* sp. nov.; male hypopygium, details.
27. *Tipula* (*Oreomyza*) *pingi* sp. nov.; male hypopygium, details.
28. *Tipula* (*Oreomyza*) *platyglossa* sp. nov.; male hypopygium, details.
29. *Orimarga* (*Orimarga*) *streptocerca* sp. nov.; male hypopygium.
30. *Dicranota* (*Amalopina*) *nebulipennis* sp. nov.; male hypopygium.
31. *Adelphomyia* (*Paradelphomyia*) *crossospila* sp. nov.; male hypopygium.
32. *Chionea gracilistyla* sp. nov.; male hypopygium.
33. *Gonomyia* (*Gonomyia*) *justifica* sp. nov.; male hypopygium.

PLATE 3

FIG. 34. *Erioptera* (*Erioptera*) *holoxantha* sp. nov.; male hypopygium.
35. *Erioptera* (*Empeda*) *nigrostylata* sp. nov.; male hypopygium.
36. *Ormosia nigripennis* sp. nov.; male hypopygium.
37. *Ormosia tenuispinosa* sp. nov.; male hypopygium.
38. *Ormosia fixa* sp. nov.; male hypopygium.
39. *Ormosia profesta* sp. nov.; male hypopygium.
40. *Ormosia officiosa* sp. nov.; male hypopygium.
41. *Ormosia affixa* sp. nov.; male hypopygium.
42. *Dasymolophilus jubatus* sp. nov.; male hypopygium.
43. *Dasymolophilus kibunensis* sp. nov.; male hypopygium.
44. *Dasymolophilus murinus* (Meigen); male hypopygium.
45. *Molophilus okadai* sp. nov.; male hypopygium.

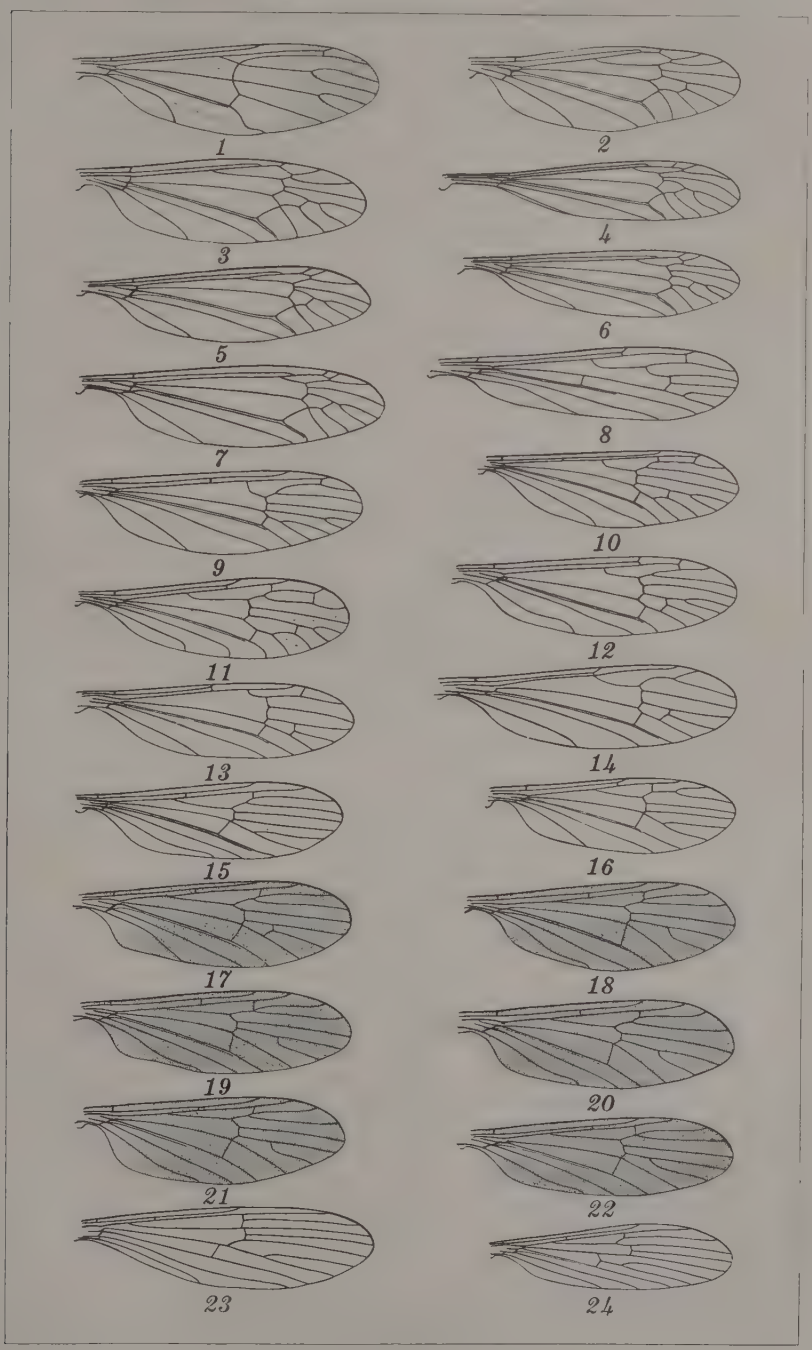

PLATE 1.

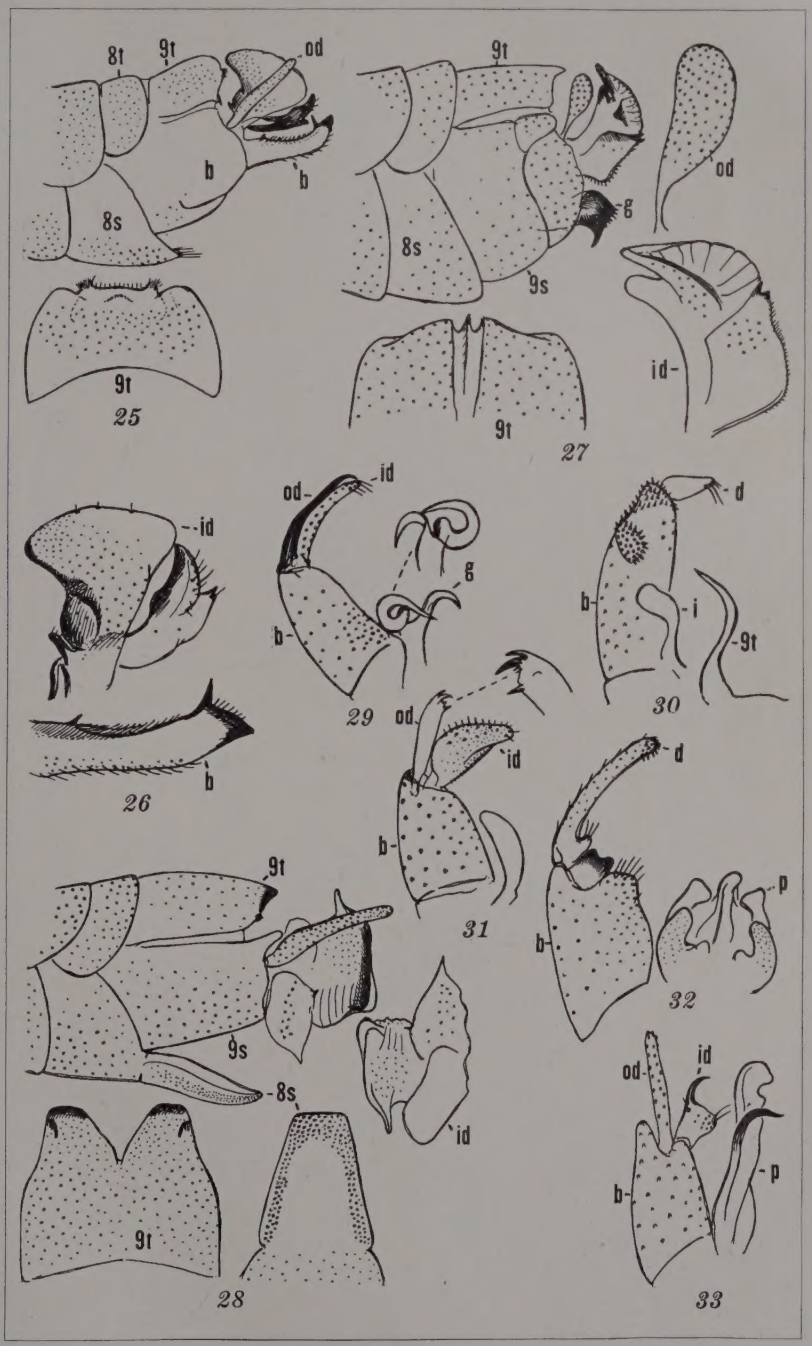
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PLATE 2.

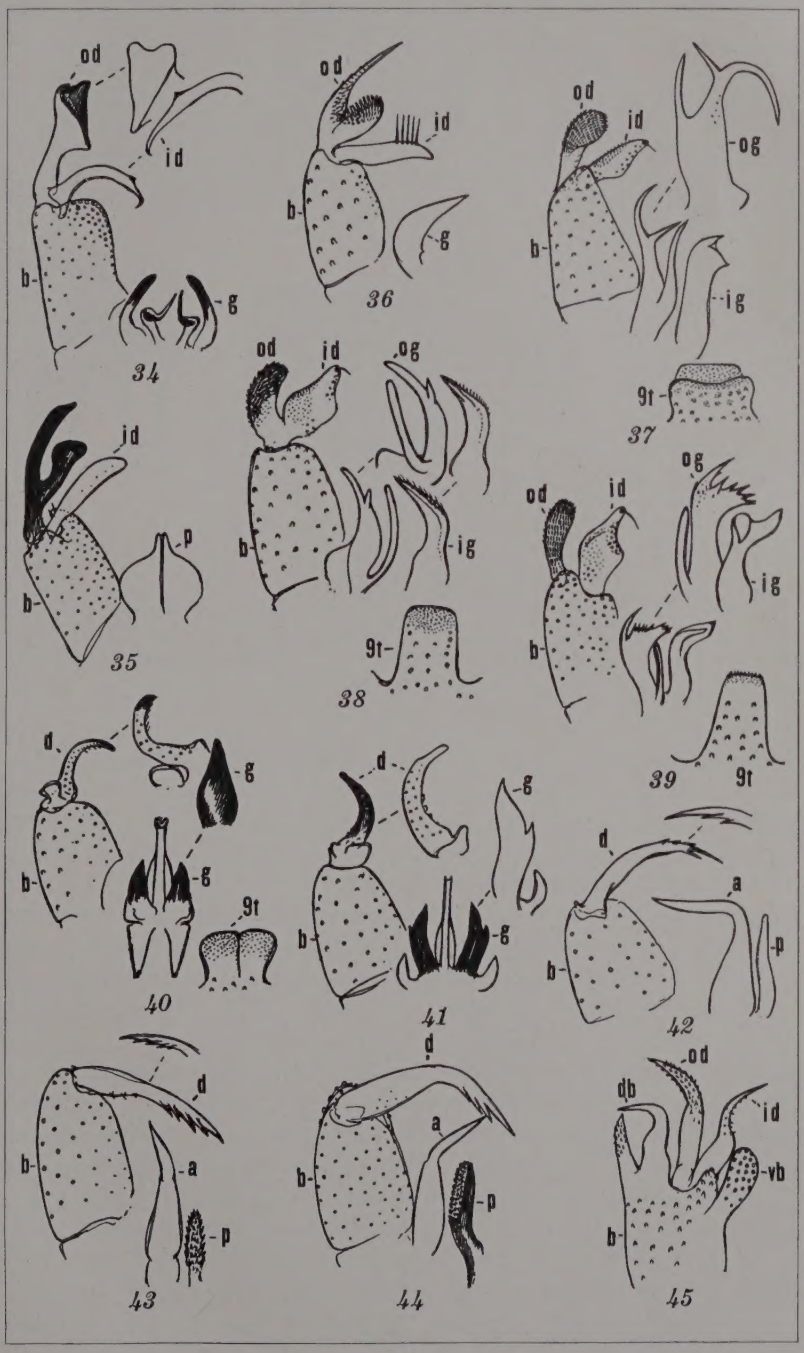
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PLATE 3.